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Environmental Impact Statement

Energy Services of Manitowoc, LLC Energy Center

Manitowoc, Wisconsin

April, 2001

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99 MW Atmospheric Fluidized Bed Energy Center
Manitowoc, Wisconsin

April, 2001

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Environmental Impact Statement

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99 MW Fluidized Bed Energy Center
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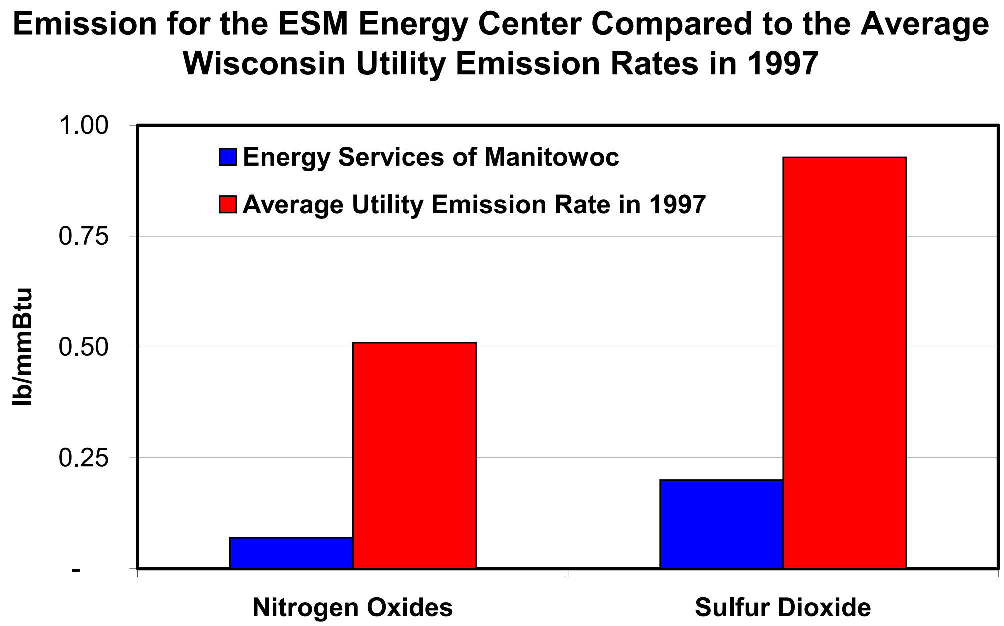
Project Description

1.1 Project Description and Need

The Energy Services of Manitowoc, LLC (Energy Services of Manitowoc, ESM, or the Company) is proposing to construct and operate a 99 MW petroleum coke-fired steam electric generating power plant referred to as the ESM Energy Center on a vacant industrial site near the City of Manitowoc Wastewater Treatment Plant in Manitowoc, Wisconsin. The location of the site is shown on a U.S. Geologic Service 7.5 minute topographic map in Figure 1.

The ESM Energy Center is being developed to supply the growing demand for energy in Wisconsin and throughout the region. The ESM Energy Center will combust fuel with neutralizing limestone in a boiler that will produce steam to drive a steam turbine and electric generator. Electricity from this power plant will supply energy requirements in northeast Wisconsin. This power plant will also be designed to supply steam to local steam hosts, if desired. Steam hosts may include the Manitowoc Public Utilities which supplies steam for heating and cooling the Lincoln High School and other municipal buildings, and Busch Agricultural Products which is located immediately adjacent to the proposed site.

The ESM Energy Center will use state of the art air pollution controls to achieve emission rates far below Wisconsin's existing coal-fired electric generating capacity. The following figure shows that the emission rates of nitrogen oxides (NO_x) and sulfur dioxide (SO_2) from this power plant are less than one–seventh and one–fourth of the Wisconsin utility fossil fuel-fired emission rates, respectively. Potential emissions from the project are summarized in Table 1-1. This power plant will require air pollution control construction and operation permits under ch. 285, Wis. Statutes, and will be a major source under the Prevention of Significant Deterioration (PSD) program in NR 405, Wis. Adm. Code. As a result, the use of the best available control technology will be required for each pollutant emitted in excess of the significant levels as defined in NR 405, including carbon monoxide (CO), nitrogen oxides (NO_x), particulate matter, particulate matter less than 10 microns in size (PM_{10}), sulfur dioxide (SO_2), and sulfuric acid mist. This power plant will not be a major source for volatile organic compounds (VOCs) or mercury. Even so, this power plant will utilize VOC and mercury controls that are recognized as the current best available control technology.



Wisconsin electric utility emission data is from the Wisconsin DNR publication, Wisconsin 1997 Sulfur Dioxide and Nitrogen Oxides Emission Report, April 1999, publication PUBL-AM-292 99.

Table 1-1. Potential emissions for the ESM Energy Center compared to the significant levels under the Prevention of Significant Deterioration program.

PSD POLLUTANT	POTENTIAL TO EMIT, tons per year	SIGNIFICANT LEVEL, tons per year
Carbon Monoxide (CO)	512	100
Nitrogen Oxides (NO_x)	326	40
Particulate Matter and PM_{10}	51	25
Sulfur Dioxide (SO_2)	931	40
Volatile Organic Compounds	39	40
Lead (Pb)	0.51	0.60
Mercury (Hg)	0.09	0.10
Fluorides	2.8	3.0
Sulfuric Acid Mist	12.1	7.0

Instead of cooling towers, the ESM Energy Center will use once-through cooling water from Lake Michigan. For this purpose, the plant will withdraw water from Lake Michigan through an intake system specially designed to minimize fish impingement and entrainment which will be located approximately 5,000 feet offshore. The facility will return the water to Lake Michigan from a new shoreline discharge structure at a maximum temperature increase of 13.4 ^{o}F. The intake and discharge structures will require permits under Ch. 30, Wis. Statutes for the placement of structures on or in the bed of Lake Michigan. Also, because this power plant will use surface water and have a surface water discharge, this plant will also require a Wisconsin Pollutant Discharge Elimination System (WPDES) permit under Ch. 283, Wis. Statutes. Water discharge from the balance of plant sources including boiler blowdown, turbine drains, water treatment plant (demineralizer) discharge, and sanitary systems will be directed to the City of Manitowoc Wastewater Treatment Plant.

1.2 The ESM Energy Center as an Eco-Industrial Park

The project sponsor considers this facility to be an example of an "Eco-Industrial Park". Eco-Industrial Parks are comprised of industries that can utilize products, including waste products, from each other. By using what would be waste products, these industries reduce their net impacts on the local environment, and sometimes a larger environment, when considering the sources of raw materials.

An example of an Eco-Industrial Park is found in Kalundborg, Denmark. The industrial symbiosis in the Kalundborg district is built up as a network between five industries and the municipality of Kalundborg. These industries trade by-products because the waste of each is a valuable raw material to one or more of the others. The result is a reduction of both resource consumption and environmental impacts. A power station is at the heart of the network, producing steam heat for the town and process steam for the refinery and pharmaceutical company. The power station's pollution control system removes sulfur dioxide from the flue gas, and produces gypsum as a byproduct. A part of the gypsum is sold to a plasterboard manufacturer. A much more detailed description of this power plant may be obtained from the Symbiosis Institute at www.symbiosis.dk. Additional information on Eco-Industrial Parks may be obtained at www.smartgrowth.org.

For this kind of beneficial relationship to work, the enterprises must be situated near each other, and waste products from one participant must fit the raw materials needs of the other. Long steam and materials pipelines are environmentally and economically costly and the greater the length, the greater the energy losses. Experience from Kalundborg shows that distance is most important when energy is being transferred. The ESM Energy Center has attributes similar to the Kalundborg facility, though not to the same degree. For instance, the ESM Energy Center will produce electricity for direct use by local and regional utilities, as well as steam for use by the City and Busch Agricultural Products. The C. Reiss Coal Company will provide existing facilities for fuel and limestone receiving. The byproduct from the flue gas desulfurization system is also gypsum, a potentially valuable byproduct for building material manufacturing and fertilizer production. Thus, this project has the characteristics of a developing Eco-Industrial Park.

1.3 New Electric Generating Capacity in Wisconsin

Since 1997, Wisconsin and other parts of the upper Midwest have experienced electric reliability problems and a declining margin of electric energy reserves. To meet the growing demand for electric energy, Wisconsin utilities and independent power producers have installed or received regulatory approval for about 3,000 MW of new capacity. This new capacity is listed below.

Table 1-2. New electric generating capacity installed or approved in Wisconsin since 1995.

STATION	TYPE	EXISTING STATION OR NEW SITE	CAPACITY, MW	
			Existing	New
Concord	Simple Cycle	Existing	340	48
DePere Energy Center	Simple Cycle	New	-	180
Germantown	Simple Cycle	Existing	266	82
LS Power - Whitewater	Combined Cycle	New	-	220
MGE Kewaunee Wind Farm	Wind	New	-	11
WPS Kewaunee Wind Farm	Wind	New	-	14
Manitowoc Public Utilities	Simple Cycle	New	-	25
Minergy[1]	Cogeneration	New	-	7
Paris	Simple Cycle	Existing	300	372
RockGen Energy Center	Simple Cycle	New	-	450
South Fond du Lac	Simple Cycle	Existing	255	85
Southern Energy	Simple Cycle	New	-	300
West Marinette	Simple Cycle	Existing	143	83
Badger Generating Company	Combined Cycle	New	-	1080
TOTAL				**2,957**

[1] The Minergy plant combusts solid fuel as well as natural gas.

The electricity generated from the ESM Energy Center will be used to supply the growing demand, and will augment and eventually replace some existing generation, especially during non-peak periods when this power plant is expected to have a lower cost. To the extent that this power plant replaces existing capacity, this plant will replace existing units that have much higher emission rates for these pollutants. This is the intended outcome of the PSD program and ensures continuing improvements in air quality.

1.3.1 Baseload Versus Peaking Capacity

Electric generating capacity is classified as baseload, intermediate, or peak load capacity. As the name implies, baseload capacity provides electric energy all day and night. Intermediate and peak load capacities are used only when electric power demand is higher and highest, respectively. The ESM power plant will be a baseload generating station. In the previous table, all of the simple cycle generation, or about 90% of the recently installed capacity, is peaking capacity.

Peaking units are installed and operated to supply energy during relatively brief periods, which generally occur on the hottest summer days when electric demand is at its peak[1]. These periods are typically from 1 – 8 hours in duration, after which electric usage subsides. In contrast, except for brief scheduled outages of approximately 2 weeks per year, baseload units are operated almost continuously.

Peaking units are characterized by low *installed costs*, but high *operating costs*, whereas baseload units are characterized by high installed costs but lower operating costs. Installed cost refers to the total capital investment of the power plant. Simple cycle combustion turbines have installed costs of about $250 per kW of generation. Conversely, solid-fuel fired baseload generating units have installed costs of approximately $1,000 per kW. Much of this is due to the need for more advanced and costly pollution control systems. The lower installed cost of simple cycle peaking units generally results in higher *operating costs*. For most generating units, the highest operating cost item is the fuel itself. For peaking units, the most common fuel is natural gas. While natural gas costs are quite volatile, electric utility natural gas costs averaged $2.64 per million British thermal units (mmBtu) in 1998. For baseload units in Wisconsin, the most common fuels are coal, wood, and petroleum coke. All of these fuels have costs below $1.75 per mmBtu. In 1998, the average electric utility coal cost was $1.07 per mmBtu[2].

1.3.2 Natural Gas Versus Solid Fuel

While natural gas is the cleanest fossil fuel for electric power generation, the diversification of Wisconsin's electric generating capacity is an important part of Wisconsin's overall energy policy. From Table 1-2, except for approximately 25 MW of wind energy and 7 MW of solid fuel capacity, all of the capacity installed in Wisconsin since 1995 is natural gas or distillate oil fired. This trend to use more natural gas-fired electric power capacity is occurring throughout the United States. According to the U.S. Department of Energy – Energy Information Administration's *Annual Energy Outlook 1999*, natural gas use for electric power generation is forecasted to almost triple in the next 20 years, increasing from 3.3 trillion cubic feet in 1997 to 9.2 trillion cubic feet by 2020[3].

Over the past twenty years, residential use of natural gas has exceeded the use of natural gas for electric power production. According to U.S. DOE

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[1] The upper Midwest electrical systems are characterized as "summer peaking" systems. This means that the highest electric demand normally occurs during hot summer days from high air conditioning loads. Some systems are "winter peaking" systems, from high winter heating loads.

[2] Wisconsin Energy Statistics – 1999, Wisconsin Department of Administration, page 100, Wisconsin Electric Utility Costs of Fuel.

[3] U.S. Department of Energy – Energy Information Administration, *Annual Energy Outlook 1999,* DOE/EIA-0383(99), page 72.

forecasts, this trend will change in the next 20 years, so that by the year 2020, natural gas use for electric power generation will be almost twice as high as natural gas for residential use. The increased reliance on natural gas for electric power generation presents several energy policy questions, including questions of long term natural gas supplies, costs, and reliability. For instance, when the new generating facilities in the above table are operated at a 10% capacity factor for simple cycle units and a 65% capacity factor for the combined cycle or cogeneration units (typical operation of these units), the total annual natural gas consumption for this new capacity is about 32 trillion Btu (32 billion cubic feet) per year. This energy consumption is equal to about one-third of the total annual residential natural gas usage for the entire state of Wisconsin[4].

The increased use of natural gas for electric power generation is already leading to natural gas supply shortages and price increases. In an article from the Public Service Commission of Wisconsin, the PSCW indicated that natural gas prices throughout the nation soared through the end of December. The cost of gas at the wellhead for the month of January was more than four times higher than the prices for the month of January one year ago. The PSCW indicated that the cost of gas at the wellhead for the month of January will be about $9.87 per Dekatherm (Dth). This compares to the already high December 2000 price of roughly $6.00 per Dth. The index price for the month of January 2000 was $2.28 per Dth.

Domestic natural gas reserves are expected to last approximately 60 years at current consumption levels. However, with domestic natural gas consumption forecasted to increase by 50% by 2010, the long term natural gas supply will be consumed much more rapidly. Natural gas is a valuable resource for residential and commercial heating. Conversely, the widespread use of coal or wood for residential heating purposes is neither likely nor environmentally desirable. Using coal or wood in homes would require new, more expensive and larger furnaces, and without very expensive control systems, would result in significant increases in soot and particulate matter emissions. As a result, a balanced electric capacity addition of both natural gas-fired and state of the art solid fuel-fired facilities may be the optimal policy in Wisconsin for ensuring both reliable electric capacity and minimizing environmental impacts.

1.3.3 Petroleum Coke as a Fuel

Petroleum coke is a residual or waste fuel produced from the refining of crude oil. Petroleum coke has a high heating value and a high sulfur content, but has very low ash and mercury contents. In appearance, it looks much like coal. The production of petroleum coke has expanded rapidly in the 1990s, especially in the USA. Two factors have influenced this expansion; the changing qualities of

[4] According to the Wisconsin Energy Bureau report Wisconsin Energy Statistics – 1999, the 1998 residential natural gas usage was 117.7 trillion Btu.

crude oil, and environmental regulations requiring cleaner transportation fuels. The latter requirements have reduced the allowable sulfur content in transportation fuels from 0.1% to less than 0.05%. Further reductions in fuel sulfur content to reduce emissions from semi-trailer trucks and automobiles are expected to reduce these levels to less than 0.005%. To achieve these low sulfur contents in transportation fuels, the sulfur is captured in the petroleum coke. As a result, these more stringent regulations have increased petroleum coke production and sulfur content.

Petroleum coke has been used for years as part of the fuel blend at cement plants and steam-electric generating facilities. For instance, the Manitowoc Public Utilities's existing CFB boiler utilizes petroleum coke with coal, and controls sulfur dioxide (SO_2) emissions by 90%. Petroleum coke is also combusted in other electric generating utility boilers in Wisconsin without any SO_2 control systems. For instance, the Wisconsin Electric Power Company's Valley Power Station in Milwaukee combusts petroleum coke in combination with coal. The current air pollution control operation permit for this facility allows the facility to combust up to 300,000 tons per year. Since this facility does not have SO_2 control systems, the allowable SO_2 emission rate is 3.28 lb/mmBtu, or almost 15 times the proposed allowable emission rate for the ESM Energy Center.

In the past decade electric generating plants have come on line in the USA which utilize petroleum coke as their sole fuel source. In July of this year, the Bay Shore Power Plant came on line in Oregon, Ohio. This plant is situated near a petroleum refinery and combusts petroleum coke as the primary fuel. This facility is required to reduce SO_2 emissions by 90%, with a maximum allowable SO_2 emission rate of 0.73 lb/mmBtu. The use of petroleum coke as a fuel reduces the overall refining costs (and the subsequent cost of petroleum based products) by providing an additional revenue to the refiner. Using a fluidized bed boiler to burn petroleum coke at the proposed ESM Energy Center would reduce potential SO_2 emissions by 97.5%, and would be the most advanced, cleanest method for utilizing this fuel in the world.

Because the ESM Energy Center will be a major source of SO_2 emissions under the Prevention of Significant Deterioration (PSD) program in NR 405, Wis. Adm. Code, this facility must use the use of the best available control technology (BACT) to control these emissions. The SO_2 emission limitation for the ESM Energy Center of 0.2 lb/mmBtu on a 12-month rolling average basis is more restrictive than the most restrictive limit for any new facility combusting petroleum coke as the primary or sole fuel.

On August 17th, 2000, the U.S. EPA published in the *Federal Register* a draft of its guidance on BACT for gas turbine combined cycle units using dry low NOx combustors (DLN CCTs). In summary, the guidance indicates that a state may properly conclude that the lower NO_x emission rate resulting from the requirement to use an additional pollution control system called selective catalytic reduction (SCR) may not be appropriate as BACT because "If SCR is required on new (DLN CCTs), the added capital and operating costs of SCR may mean that more electricity will be produced by dirtier plants. This could occur because fewer of these plants will be built and because less electricity will be generated from those that are built. Therefore, total NO_x emissions could increase, not decrease, as a result of requiring SCR on these plants." This broad view for determining BACT is applicable to the ESM Energy Center. Petroleum coke has high sulfur levels because the sulfur removed from transportation fuels to comply with the low sulfur requirements is captured in the petroleum coke. Although lower sulfur fuels could be required to further reduce emissions, if the petroleum coke is not burned at this plant, it is likely to be burned elsewhere at higher emission rates. Since this plant will achieve the highest level of SO_2 control of any facility in the Midwest, utilizing petroleum coke in this facility could actually reduce regional SO_2 emissions by removing petroleum coke from the market which is likely to be burned uncontrolled.

1.4 Site Description

The proposed location for this power plant is a vacant industrial site with abandoned railroad tracks and an abandoned foundry building in the City of Manitowoc. The site is zoned I-2, Heavy Industrial. This site is bordered on the east by Lakeview Drive and the City Wastewater Treatment Plant, on the north by the C. Reiss Coal Company, and on the west by the Wisconsin Central Rail corridor and the Busch Agricultural Products Company. Figure 2a is a photo of the existing site showing the existing rail corridor and neighboring industries. Figure 2b shows the proposed transmission line route from the ESM Energy Center to the existing Manitowoc Public Utilities generating station. Figure 3 is a general layout for this power plant, and also shows its location relative to the Busch Agricultural Products facility, the C. Reiss Coal Company, and other facilities.

Petroleum coke and limestone will be received via rail, truck, or barge. The proposed site is favorably located to provide direct access to all three transportation methods without the need for significant new infrastructure. The site is less than one-half mile north of the Manitowoc Public Utilities' electric generating station and electric transmission system, and is located very near to the steam hosts. Finally, the site is located next to the C. Reiss Coal Company, which has existing facilities for receiving and storing coal, petroleum coke, and limestone. Therefore, much of the required support infrastructure for this power plant is already in place.

1.5 Process Description

The ESM power plant will utilize an atmospheric pressure circulating fluidized bed boiler to fire petroleum coke and fuel oil as a start-up fuel. The boiler will produce steam that will be used to turn a steam turbine/electric generator set to produce electricity, and to provide process and heating steam to the City of Manitowoc and adjacent industrial facilities. The entire power plant will be engineered, procured, and constructed by Alstom Power. The overall process flow diagram is shown in Figure 4.

The ESM plant will also include a number of material handling processes, including solid fuel and limestone handling, crushing, and conveying, and ash conveying and handling operations. The solid fuel railcar unloading and outdoor storage processes, as well as the raw limestone barge unloading and raw limestone storage processes will be owned and operated by the C. Reiss Coal Company. These activities will be performed on the C. Reiss Coal Company property adjacent to the proposed ESM plant.

1.5.1 Atmospheric Pressure Fluidized Bed Boiler

The Atmospheric Pressure Circulating Fluidized Bed boiler (CFB) boiler will be the heart of the generating station, providing the steam necessary to power the steam turbine and electric generator. Figure 5 is an elevation drawing of the boiler, boilerhouse, and air pollution control equipment.

Both the U.S. Department of Energy and the U.S. Environmental Protection Agency consider CFB boiler technology a “Clean Coal Technology”. It differs from conventional utility power boilers utilizing pulverized coal, stoker, or cyclone boiler technology, since it has the ability to significantly reduce emissions of sulfur dioxide (SO_2) and nitrogen oxides (NO_x). These two pollutants are of concern in acid deposition and, in the case of NO_x emissions, ground level ozone formation. The use of limestone as part of the fluidized bed “matrix” and the relatively low combustion temperatures, respectively, are responsible for reducing SO_2 and NO_x emissions.

The CFB boiler will combust petroleum coke (and natural gas or fuel oil during startup) in a limestone matrix. In the furnace section of the CFB boiler a mixture of fuel, limestone, char and ash is suspended or “fluidized” in an upwardly flowing gas stream. Although the fuel particles and limestone are solids, the combination of fuel particles, limestone and combustion air exhibits fluid-like properties. Combustion air forced in at the bottom of the furnace keeps the bed in a constantly upward moving flow. At the top of the furnace, relatively large entrained particles are separated (sink) from smaller ash particles and are returned to the furnace until combustion is complete. That is why this combustion technology is referred to as a *circulating* fluidized-bed (CFB) boiler.

Combustion takes place within the furnace “bed” at relatively low combustion temperatures ranging from 1,500 to 1,650°F. (Typical pulverized coal-fired boilers have flame temperatures of 2,000 – 2,400 ^{o}F; cyclone boilers have flame temperatures of more than 3,000 ^{o}F.) Because thermal NO_x formation is a high temperature process occurring at temperatures in excess of 2,000°F, the lower CFB boiler operating temperature significantly reduces NO_x production. The addition of limestone to the fluidized bed allows the boiler to remove fuel sulfur directly in the boiler.

1.5.1.1 Air Pollution Control Equipment

The Control Technology Review required for the PSD air pollution control permit application identified four major air pollution control systems which ESM proposes as the best available control technology (BACT), including the CFB boiler itself, a dry flue gas desulfurization (scrubber) system, a fabric filter baghouse, and a selective non-catalytic reduction (SNCR) system. Detailed emissions data for this power plant are included in Chapter 3.1 of this EIS.

1.5.1.2 Carbon Monoxide (CO) and VOC Control Systems

The CFB boiler is an inherently efficient combustion device. The turbulent nature of the fluidized bed combined with advanced air staging and combustion controls helps achieve high combustion efficiencies and low CO and VOC emission rates. Good combustion controls have been identified as BACT in all previous reviews of similar facilities, and were also determined to be BACT for this power plant.

1.5.1.3 Nitrogen Oxide (NO_x) Control Systems

This plant will use the CFB boiler technology in combination with a selective noncatalytic reduction (SNCR) system to control nitrogen oxide (NO_x) emissions. The CFB boiler has inherently low NO_x emissions because of its low operating temperature. SNCR offers additional NO_x reductions in the CFB boiler by injecting ammonia or urea to reduce NO_x to water and molecular nitrogen. With the use of the CFB boiler technology and SNCR, this unit will achieve a NO_x emission rate of 0.07 lb/mmBtu. Based on a unit heat rate of 10,000 Btu/kWh, this emission rate is equal to 0.7 lb/MWh. This emission rate is less than one-half of the new source performance standard for this unit promulgated under 40 CFR Part 60 in 1998, and constitutes BACT for this power plant.

1.5.1.4 Particulate Matter (PM and PM_{10}) Control System

The ESM Energy Center will utilize a pulse-jet fabric filter baghouse for PM and PM_{10} control. Fabric filter baghouses have been determined to be BACT for numerous similar facilities permitted under the PSD rules in the last decade and are proposed as BACT for this power plant. In addition to very high levels of particulate matter and fine particulate matter (PM_{10}) control, the baghouse system also augments the performance of the SO_2 flue gas desulfurization system. The high efficiency and low operating temperature of the baghouse also improves the collection of trace hazardous air pollutants including mercury.

1.5.1.5 Sulfur Dioxide Control Systems

The development of CFB boiler technology has been driven by the need to reduce SO_2 and NO_x emissions from the combustion of coal and petroleum coke. To control SO_2 emissions directly in the boiler, limestone is injected with fuel directly into the fluidized bed. Within the furnace, limestone ($CaCO_3$) is first reduced or "calcined" to calcium oxide (CaO). This reaction is endothermic (heat consuming), requiring about 766 Btu/lb of limestone. Calcium oxide then reacts with SO_2 in the fluidized bed to form calcium sulfate ($CaSO_4$). This second reaction is exothermic (heat producing), liberating about 6733 Btu per pound of sulfur. Depending upon the calcium to sulfur (Ca/S) mole ratio within the bed, SO_2 removal rates in excess of 90% can be achieved.

To further reduce SO_2 emissions, the ESM Energy Center will use a state-of-the-art flue gas desulfurization (FGD) system called the Novel Integrated Desulfurization (NIDS) system. The NIDS system is a dry FGD system and is based on the reaction between calcium hydroxide ($Ca(OH)_2$) and sulfur dioxide (SO_2) in humid flue gas conditions to form calcium sulfite. The NIDS system utilizes excess lime or calcium oxide (CaO) in the ash produced in the CFB boiler and captured in the baghouse. Water is added to the ash to form calcium hydroxide, and the hydrated ash is then reinjected into the flue gas upstream of the baghouse. SO_2 in the flue gas reacts with calcium hydroxide to form calcium sulfate which is captured in the baghouse. The NID system is different from a conventional spray dry FGD process in that the ash is humidified but remains a free-flowing solid, eliminating the need for slurry handling, atomization, and a large reactor and improving the reliability of the process. The NID system also differs from a conventional spray dry FGD process in that the solids recirculation rate is 30 to 100 times compared to 3 – 5 times in a conventional spray dry FGD system. This ensures a high utilization of the lime reagent.

1.5.1.5.1 Flue Gas Exit Temperature

The NID FGD process is controlled by regulating the amount of water added to the ash. In practice, water will be added to control the baghouse outlet temperature to approximately 142 ^oF, or approximately 40% relative humidity. This temperature is similar to or somewhat lower than conventional spray dry FGD systems with an approach temperature of 25 ^oF above the saturation temperature (the saturation temperature is typically 123 ^oF). Conversely, wet FGD systems typically operate at the saturation temperature and then use reheat air to increase the stack temperature. The low temperature of the NID system will increase the condensation of condensable particulate matter including mercury and other trace hazardous air pollutants. This low flue gas temperature combined with the use of the fabric filter baghouse will result in a very high level of particulate matter control.

1.5.2 Fuel and Limestone Supply Requirements

The proposed power plant will utilize petroleum coke as the primary fuel. Distillate fuel oil will be used as a startup fuel, and will also be used to dry the limestone prior to use in the boiler. The maximum petroleum coke consumption will be 330,000 tons per year. In addition, the plant may use up to 230,000 tons per year of limestone from a local quarry. At a typical plant capacity factor of 80%, the normal petroleum coke and limestone usage will be 270,000 and 185,000 tons per year, respectively. Limestone may be supplied from local limestone quarries within or near Manitowoc County, from Green Bay, or even from Iowa.

1.5.3 Materials Handling Processes

Material handling processes include processes necessary to operate the boiler, including solid fuel unloading, storage, reclaim, crushing, and conveying, limestone unloading, storage, reclaim, crushing, drying, and conveying, and ash conveying and handling operations. These sources are listed below. See Figures 4, 6, and 7 for the process flow description of these processes.

	MATERIAL HANDLING PROCESSES
1	Solid Fuel Railcar Unloading
2	Solid Fuel Load-Out to Outdoor Storage
3	Solid Fuel Outdoor Storage
4	Solid Fuel Reclaim
5	Solid Fuel Crusher House and Conveyor
6	Solid Fuel Storage Silo Vent
7	Barge Raw Limestone Unloading
8	Outdoor Raw Limestone Storage
9	Outdoor Raw Limestone Reclaim
10	Railcar and Truck Raw Limestone Unloading
11	Railcar and Truck Processed Limestone Unloading
12	Limestone Preparation (Crushing & Drying) Building
13	Limestone Silo Vent
14	Ash Silo Load-In
15	Ash Silo Load-Out

1.5.3.1 Fuel Handling and Preparation

Solid fuel handling will include unloading, storage, reclaim, crushing, and conveying. Solid fuel unloading, storage, and reclaim are fugitive dust sources, while the crushing and storage silo are point sources. The overall fuel handling process flow diagram is included as Figure 6, Solid Fuel Process Flow Diagram.

1.5.3.1.1 Process F11: Solid Fuel Railcar Unloading

Solid fuel including petroleum coke will be received and unloaded at the C. Reiss Coal Company located directly adjacent to the ESM power plant. The C. Reiss Coal Company is an existing Company that manages and sells coal and petroleum coke to facilities in or near the City of Manitowoc. When petroleum coke is delivered via railcar, it will be unloaded inside a new building with a receiving hopper under the tracks, constructed primarily for receiving and reclaiming fuel for this power plant. The fuel may then be conveyed directly to the crusher house and the plant for fueling the boiler, or it may be loaded out to the storage pile.

The rail cars transporting petroleum coke to this power plant will be "bottom dump" type cars. Since the unloading facilities will not have provisions for railcar thawing, railcar unloading will only occur during spring, summer, and fall when temperatures are above freezing. Under normal conditions, 15 rail cars (1500 tons) would be unloaded in a 24-hour period. Unloading will normally occur during the daytime hours. Of the 15 cars unloaded, 9 cars (900 tons) would be conveyed directly to the crusher and boiler, and 6 cars would be conveyed to storage. To control dust emissions, the unloading hopper will be located inside a building to contain fugitive dust generated and reduce wind speeds. In addition, a water spray dust suppression system will be used to further reduce dust at the hopper opening.

1.5.3.1.2 Process F12: Load-Out to Outdoor Storage

When the petroleum coke is loaded-out to storage, it will be conveyed in covered conveyors to a stacker boom. The stacker boom is an adjustable height conveyor equipped with a telescoping chute. The boom senses the pile height and adjusts up or down to minimize the total drop height. The telescoping chute encloses the area where the fuel drops onto the storage pile. Finally, dust suppression sprays will be used to suppress dust generated during this process, and also minimize dust from storage.

1.5.3.1.3 Process F13: Outdoor Solid Fuel Storage

As discussed above, petroleum coke will only be delivered to this power plant during months when freezing conditions are not expected. The C. Reiss Coal Company is expected to store up to 100,000 tons of petroleum coke for this power plant in open storage piles. Delivery will normally occur in late fall, just before freeze-up and the onset of winter. This storage pile will be considered an "active" pile. This means that the pile will involve regular grading, compaction, and shaping, as well as regular in- and out-loading. To control dust, water may be sprayed on the fuel as it is loaded out to the storage pile. In addition, a wind barrier wall will be constructed on the east, west, and north edges of the coal yard as shown in Figure 3.

1.5.3.1.4 Process F14: Solid Fuel Reclaim

Solid fuel including petroleum coke will be "reclaimed" from outdoor storage using an end loader. The end loader will pick up the petroleum coke from storage piles, enter an enclosed area, and dump it into the reclaim hopper. From the reclaim hopper, the fuel will be fed to conveyors that will carry it to the crusher house and the boilerhouse fuel silos. To control the end loader dust emissions, the reclaim area will be watered and treated with dust suppression chemicals after extended dry periods when fugitive dust may be generated.

1.5.3.1.5 Process P15: Solid Fuel Crusher House and Conveyors

After the petroleum coke is loaded into the reclaim hopper, the fuel will be conveyed to the crusher house where it will be crushed to a size of ¼ inch (6.4 mm) or smaller. This relatively large particle size is a significant advantage of CFB boilers over conventional pulverized coal-fired units, reducing fuel preparation costs, energy requirements, and dust generation. After crushing, the fuel will be conveyed to the boilerhouse fuel silos, which are large enough to hold approximately one day of fuel supply at full boiler load.

The solid fuel conveyors will be covered to control wind blown dust. Dust may be generated at transfer points where the petroleum coke is transferred from hoppers to conveyors, conveyors to hoppers, or conveyors to conveyors. To control dust, these transfer points are enclosed and also have guards to minimize spillage and the release of dust. In addition, the transfer points will also have dust pickup hoods which will direct the particulate laden air to a fabric filter baghouse for filtering prior to discharge.

1.5.3.1.6 Process P16: Solid Fuel Storage Silo Vents

After crushing, solid fuel is conveyed into the boilerhouse and stored in silos or day tanks. These silos and the conveyor transfer points in the "tripper" room are equipped with exhaust fans for dust control. The fan exhaust will be controlled by a fabric filter baghouse prior to discharging the air back into the tripper room. The collected material is returned directly to the fuel day tanks.

1.5.3.2 Limestone Processing Equipment

Limestone may be received at the ESM Energy Center in two forms: raw, unprocessed limestone, and processed limestone. Raw limestone must be processed by drying and crushing before it can be used in the CFB boiler. Raw limestone may be received via barge, truck, or rail. When received by barge, up to 25,000 tons or a 40 day supply of raw limestone may be stored outside. When received by railcar or truck, the raw limestone will be unloaded to the limestone receiving hopper located inside the unloading building. From the receiving hopper, limestone may be conveyed to short term storage inside the limestone building, or directly to the Limestone Prep. Building for drying and crushing. After crushing and drying, the limestone is conveyed pneumatically to the boiler.

Processed limestone, which may be received at the ESM power plant via truck or railcar will be unloaded in a building located near the limestone storage silo. (shown in Figure 3). The processed limestone will be conveyed via a bucket elevator directly to the limestone day silo located near the boilerhouse. The overall limestone process flow diagram is shown in Figure 7.

1.5.3.2.1 Process F21: Barge Raw Limestone Unloading

Limestone may be delivered via barge to the ESM power plant as 2 inch or smaller material. This limestone is reduced in size, but is not crushed. In addition, this material has been washed to reduce fines content, so that the moisture content averages 5.0%. As a result, the delivered limestone does not contain a large amount of fines or silt, and is a relatively wet product. When delivered in this fashion, the limestone can actually freeze solid in winter months. The limestone will be unloaded with a barge equipped unloading boom. The unloading boom is an adjustable height conveyor equipped with a telescoping chute. The boom senses the pile height and adjusts up or down to minimize the total drop height. The telescoping chute encloses the area where the fuel drops onto the storage pile.

1.5.3.2.2 Process F22: Outdoor Raw Limestone Storage

As discussed above a barge will deliver up to 25,000 tons of limestone at a time. The maximum storage on the ground is expected to be no more than 50,000 tons per year. As with fuel, this storage pile will be considered an “active” pile. This means that the pile will involve regular work to grade, compact, and shape the pile, as well as regular loading in and out from the pile. To control emissions from the outdoor limestone storage pile, dust suppression chemicals will be added to the limestone as it is loaded out to the storage pile. In addition, a wind barrier wall will be constructed on the east, west, and north edges of the coal yard.

1.5.3.2.3 Process F23: Outdoor Raw Limestone Reclaim

Limestone will be reclaimed from outdoor storage using an end loader. The end loader will pick-up limestone from storage and dump it into the railcar limestone unloading hopper or the limestone storage building reclaim hopper.

1.5.3.2.4 Process F24: Railcar and Truck Limestone Unloading

When limestone is delivered to the ESM power plant via railcar, the limestone will be unloaded into the railcar unloading hopper. The limestone may then be conveyed to the limestone unloading and storage building, or it may be conveyed directly to the limestone preparation building for use in the boiler. When limestone is delivered via truck, it may be unloaded directly into the storage building, or it may also be unloaded into the railcar unloading hopper. When limestone is received in this manner, there will be no outdoor storage, and no significant use of the end loader for limestone reclaim.

1.5.3.2.5 Process F25: Railcar and Truck Processed Limestone Unloading

When processed limestone is delivered to the ESM power plant via railcar, the limestone will be unloaded into the railcar unloading hopper located near the boiler limestone silo. The limestone will then be conveyed by a bucket conveyor directly to the boiler limestone silo. When limestone is received in this processed, dried and crushed form, there will be no outdoor storage, and no use of the limestone drying and preparation equipment.

1.5.3.3 Process P26: Limestone Preparation (Crushing and Drying)

After the limestone is loaded into the reclaim hopper, it will be conveyed to the limestone crushing and drying building where it will be crushed to a size of ¼ inch (6.4 mm) or smaller. After crushing, the limestone will be pneumatically conveyed to the boilerhouse limestone day silo. The limestone conveyors from the railcar unloading hopper and storage building to the crusher building are conventional belt conveyors. These conveyors will be covered to control wind blown dust from the conveyors. As with the fuel conveyors, dust will be generated at transfer points where the limestone is transferred from hoppers to conveyors, conveyors to hoppers, or conveyors to conveyors.

During the crushing operation, the limestone is dried using heated air from a natural gas or oil burner. The dryer burner has a heat input capacity of 10.0 mmBtu/hr. Flue gas from the dryer natural gas combustion contains entrained limestone which is separated in a cyclone followed by a baghouse prior to being vented to a the atmosphere. The manufacturer of the limestone drying and conveying system has provided the following air pollutant discharge data:

POLLUTANT	EMISSION RATE	
	lb/hr	ton/yr
Carbon Monoxide	0.2	0.58
Nitrogen Oxides	1.2	3.50
Particulate Matter	1.0	2.92
Sulfur Dioxide	0.006	0.03
Volatile Organic Compounds	0.1	0.29

The annual emissions in the above table are based on a maximum power plant limestone consumption of 230,000 tons per year, and a limestone preparation system capacity of 30 tons per hour.

1.5.3.3.1 Process P27: Limestone Silo Vent

After crushing, the limestone is discharged to an enclosed, pressurized pneumatic conveying system. This system will convey the crushed limestone to a storage silo inside the boiler house. Air from this conveying system is vented through a baghouse at the storage silo.

1.5.3.4 Ash Processing Equipment

Ash will be collected from the boiler, backpass, NID FGD system, and baghouse, conveyed to a storage silo, and loaded out to trucks or railcars for offsite reuse or disposal.

1.5.3.4.1 Ash Silo Load-In

A pressurized ash conveying system will convey the ash pneumatically from the boiler, backpass, NID FGD system, and baghouse sources to the ash silo. The ash and pneumatic conveying air will enter a cyclone separator at the silo which will remove the majority of the ash from the conveying stream. The conveying air will then pass through a baghouse prior to discharge to the atmosphere.

1.5.3.4.2 Ash Silo Load-Out

Ash will be loaded out from the silo to enclosed tank railcars or tank trucks through a gravity fed spout. The unloading process will take place inside an enclosure directly under the silo. The unloading spout is designed to capture entrained dust and return it to the unloading stream. This unloading spout uses a telescoping assembly and cone discharge for loading into enclosed trucks or railcars. The cone discharge provides a seal against the tank, while a fan induces a negative pressure at the exit of the spout. The negative pressure pulls entrained particulate matter up through an annulus in the spout body. The dust laden air is then filtered by a series of cartridge filters before it is discharged.

1.5.4 Water Supply and Wastewater Discharge

There will be two major water supplies for the proposed plant. A once through cooling system, using water from Lake Michigan, is proposed to remove waste heat from the steam turbine condenser. Water for the boiler, drinking and sanitary water, and ancillary equipment will be supplied by the City of Manitowoc municipal water system.

There will be three wastewater streams for this power plant. The once through cooling system will have a separate outfall directly to Lake Michigan. Water discharge from the balance of plant sources including boiler blowdown, turbine drains, the water treatment plant (demineralizer) discharge, and sanitary systems will be directed to the City of Manitowoc Wastewater Treatment Plant.

Storm water from this power plant will be limited to the property itself. There will be no outdoor storage of petroleum coke or limestone directly on the Energy Services of Manitowoc site. Outdoor solid fuel and limestone storage will be confined to the existing the C. Reiss Coal Company site.

1.5.5 Once Through Cooling System

The ESM-EC will be designed to operate with a once through cooling system that uses water from Lake Michigan to remove low grade heat from the steam turbine. The system will consist of an intake system, transport pipe, screen house, pumps, condenser, and outfall system. It will have a maximum flow rate of 76,000 gallons per minute (169 ft^3/sec) at a maximum temperature rise of 13.4 ^oF. The proposed location of the cooling water intake and discharge systems are shown in Figure 9. A process flow diagram of the once through cooling water system is shown in Figure 10. Additional information on this system is included in Chapter 3.

Placement of these structures on the bed of Lake Michigan will require permits under s. 30.12, Wis. Statutes for the structures, and a contract under s. 30.20, Wis. Statutes for the removal of dredging materials.

1.5.5.1 Cooling Water Intake System

The cooling water intake system (CWIS) will consist of two (2) Johnson Screens® wedge wire screen cylinders. The CWIS will be designed with a maximum slot or approach velocity of no more than 0.5 feet per second at the maximum design flow of 76,000 gpm. This velocity has been demonstrated to significantly reduce the potential to attract or entrain fish and other aquatic life in the cooling water flow and is considered the Best Available Technology for cooling water intake systems. The Johnson Screen cylinders will be manufactured from a proprietary alloy which inhibits zebra mussel growth and limits the need to use chemicals for zebra mussel control. The general arrangement of the CWIS is shown in Figure 11.

1.5.5.2 Cooling Water Discharge System

The outfall for the cooling water system will be a shoreline discharge as shown in Figure 12. The discharge structure will include a channel with tight sheeting and riprap for erosion control. The discharge weir will have an estimated average depth of 0.86 feet at an average discharge velocity of 4.3 feet per second.

1.5.6 Ash Byproducts

The primary byproduct from the flue gas desulfurization system and baghouse particulate control system is calcium sulfate or *gypsum,* mixed with calcium oxide or lime. The byproduct will be collected and transported in its dry form. Gypsum is a common mineral that is used for making drywall and plaster of Paris. Lime is also a common material used for making cement. With the addition of water, this product has cement-like characteristics and has a number of potential beneficial reuses, including drywall manufacturing, low strength concrete production, and fertilizer.

Gypsum is chemically stable in the fluidized bed and is removed from the bed or in the fabric filter baghouse as a solid. Based on the maximum rated capacity of the boiler and 8,760 hours per year of operation, the ESM power plant would produce about 72,000 tons per year of gypsum. Based on a typical gypsum density of 159 pounds per cubic foot (4,300 lb/yd^3), this maximum gypsum generation is equal to about 33,500 yd^3 per year.

1.5.7 Electrical Transmission System

The construction of this power plant will include the installation of a double circuit 138,000 volt (138 kV) electric transmission line from the power plant to the Manitowoc Public Utilities electric generating station substation located approximately one-quarter mile south of the proposed site. The transmission line will utilize the existing rail corridor. The proposed route is shown in Figure 2b. The route for the transmission line will follow the existing rail corridor. A typical double circuit 138,000 volt line structure is shown in Figure 13. The line is expected to require about six poles or structures to span the entire distance.

The installation of this transmission line and the operation of the ESM-EC may require upgrades to the American Transmission Company's transmission systems. While these upgrades may require new substation equipment and transmission line upgrades, it is not anticipated that these upgrades will require any new transmission lines.

1.5.8 Steam Supply

The proposed power plant will also supply steam to the City of Manitowoc and the Busch Agricultural Products facility. Steam will be supplied using "extraction" steam from the turbine, and will be transported via insulated underground steam pipes. The location of the proposed power plant directly adjacent to the Busch Agricultural Products facility and near to the City of Manitowoc's existing steam lines will minimize the distance steam must be transported.

Utilizing steam for process and building heating is an important and energy efficient concept often referred to as "cogeneration". The use of process steam in this manner reduces or eliminates the combustion of fuels at these sites, improving process efficiency and reducing pollutant emissions.

1.6 Buildings and Structures

The proposed power plant will include a number of buildings and structures. The overall plant layout and building dimensions are shown in Figure 3. The most prominent structure will be the stack. The stack will be a free standing, steel structure with a height of 300 feet above grade and an exit diameter of 10 feet. For comparison, the Manitowoc Public Utilities located one-half mile to the south has two concrete stacks which are 250 feet above grade with exit diameters of approximately 12 feet.

The most prominent building on the site will be the boilerhouse, which will have a height of approximately 150 feet above grade. For comparison, the tallest building on the Busch Agricultural Products property is about 200 feet above grade. An elevation view of the ESM-EC is shown in Figure 5.

1.7 Plant Staffing

When in full operation, the proposed power plant is expected to employ 20 – 25 full time employees. Fuel, limestone, and other ancillary services are expected to employ approximately 10 additional full-time equivalent positions.

1.8 Support Facilities

The ESM plant will also include a number of material handling processes, including solid fuel and limestone handling, crushing, and conveying, and ash conveying and handling operations. The solid fuel railcar unloading and outdoor storage processes, as well as the raw limestone barge unloading and raw limestone storage processes will be owned and operated by the C. Reiss Coal Company. These activities will be performed on the C. Reiss Coal Company property adjacent to the proposed ESM plant. To operate the plant, petroleum coke and limestone will be received via rail, truck, or barge. The proposed site is uniquely located to provide direct access to all three transportation methods without the need for significant new infrastructure. The site has rail access, barge unloading access, and is less than one-half mile north of the Manitowoc Public Utilities' electric generating station and electric transmission system. Finally, the site is located directly adjacent to the C. Reiss Coal Company which has existing facilities for receiving and storing petroleum coke. Therefore, much of the required support infrastructure for this power plant is already in place.

1.9 Project Schedule

The following is the anticipated construction schedule for this project:

Submit Air Pollution Control Permit Construction Permit applications to the Wisconsin Department of Natural Resources.	May 26, 2000
Submit Wastewater Discharge Permit applications to the Wisconsin Department of Natural Resources.	July 28, 2000
Receive Construction Permits.	June, 2001
Award Contracts for Construction of the Power Plant.	July, 2001
Commence Construction.	July, 2001
Shakedown of Power Plant.	May, 2003
Commence Commercial Operation.	June, 2003

Chapter 2. Existing Environment of the Power Plant Site

2.1 Physical Environment

2.1.1 Geology

The proposed site in Manitowoc lies within the Eastern Ridges and Lowlands Physiographic province of Wisconsin. The surface and near surface deposits in the area consist of Pleistocene glacial deposits deposited 10,000 to 15,000 years ago, lake bed sediments, and recent fluvial or river and flood deposits. The bedrock geology consists of gently eastward dipping Silurian through Cambrian sedimentary rocks which are 400 – 550 million years old overlying Precambrian metamorphic rocks which are 550 million years old. The following descriptions of the geology and hydrogeology of the area are based on Paull and Paull (1977), Emmons (1985), Webb (1989), and Dott (1990).

2.1.1.1 Surface Geology

The surficial geology in the vicinity of the site consists of Pleistocene glacial deposits, lake bed sediments, and recent fluvial deposits. The Pleistocene deposition took place during several advances and retreats of the Lake Michigan Lobe of the Laurentide ice sheet during the late Wisconsin period approximately 14,000 to 18,000 years ago. Several till units or materials deposited by glacial ice, in stratigraphic succession from youngest to oldest, were deposited in the area during the glacial epoch: the Two Rivers Till, Manitowoc Till , Shorewood Till, and the Wadsworth Till. These tills are mixtures of clays, sands, silts, and gravels.

Other glacial and outwash or glacial meltwater stream sediments are comprised of mixtures of clay, silt, sand, gravel and boulders, with intermittent deposits of stratified sand and gravel. Lake silt and clay deposits as well as organic layers are present in various thicknesses throughout the region. The thickness of the surficial deposits in the region ranges from less than 50 to more than 150 feet thick. The estimated thickness of the deposits in the area of the site is about 100 feet and consists primarily of till.

2.1.1.2 Bedrock Geology

The bedrock geology consists of gently eastward dipping Silurian through Cambrian sedimentary rocks overlying Cryptozoic metamorphic basement rocks. Underlying the surficial deposits descending stratigraphically are Silurian dolomites, Ordivician shales, dolomites and sandstones, and Precambrian basement rocks.

The Silurian deposits are a massive, light-gray dolomite unit with minor amounts of chert and localized shaly areas. A well developed horizontal bedding plan fracture system has been defined within the unit. The thickness of the deposit in the area of the subject site is estimated to be almost 700 feet.

The Ordivician rocks are comprised of the Maquoketa Shale, Galena Dolomite, Decorah Shale, dolomitic and shale Platteville Formation, St. Peter Sandstone, and the dolomitic Prarie du Chien Group. The Maquoketa Shale contains thin beds of dolomite and is locally dolomitic. The Galena Dolomite, Decorah Shale and the Platteville formations are similar in composition, comprised of fossil containing dolomite with thin beds of dolomitic shale, and are often undifferentiated. The St. Peter Sandstone is fine-to-medium grained and dolomitic in parts. The Prarie du Chien Group is generally described as hard, cherty dolomite, with intermittent shale beds.

The sedimentary Cambrian deposits are comprised of the Jordan Sandstone and St. Lawrence dolomite members of the Trempealeau Formation, the Franconia, Galesville, Eau Claire, and Mount Simon Sandstones. The sandstones are generally fine-to-medium grained, dolomitic, locally glauconitic, with some siltstone and shale beds.

The metamorphic Precambrain crystalline basement rocks consist of granites, quartzites, schists, and gneisses.

2.1.1.3 Soils

The soils at the site consist mainly of Shiocton very fine sandy loam with the possibility of unspecified Udorthents on the northern edge of the property. The Shiocton very fine sandy loam is classified as a coarse-silty, mixed Aquic Haploborolls, and the Udorthents is classified as a loamy and clayey, mixed, mesic Udorthents.

The Shiocton very fine sandy loam is listed as a taxadjuncts meaning that the soil cannot be classified in a series recognized in the classification system. The Shiocton series consists of somewhat poorly drained, moderately permeable soils in drainageways in glacial lake deposits. These soils formed in loamy, waterlaid deposits and are on gentle slopes ranging from 0 to 3 %.

The northern portion of the property may contain the Udorthents, which are loamy and clayey soils found in areas where the original soils have been removed or mixed by earth-moving equipment. They commonly occur in borrow areas, fill areas and sanitary landfills. Included in these mapped areas are sandy soils and other materials such as cinders, broken concrete and industrial waste. During field inspection of the site, foundry sand material was noted on the northern portion of the site. The soils in this map unit are too variable to rate for physical and chemical properties and for land use.

2.1.2 Groundwater

2.1.2.1 Aquifers and Confining Units

Several aquifers and confining units have been identified in the area of the site. The surficial sediments generally are considered to be an unconfined aquifer. However locally, fine grained clayey sediments act as confining units, creating localized areas of confined groundwater conditions. Well yields from surficial deposits generally range from 10 to 100 gal/min but locally can be as high as 500 gal/min where the surficial deposits consist of thick sands and gravels.

The Silurian dolomites are generally considered an unconfined aquifer with its base as the Maquoketa shale. Groundwater flow in the Silurian deposits occurs primarily along the well developed horizontal bedding plane fracture system. Vertical flow in the aquifer takes place along a second pair of approximately orthogonal vertically oriented fracture sets. Locally this aquifer is confined by overlying clays and silts. Well yields in the area are a function of the size and number of fractures that are intersected, and range from 5 to 600 gal/min.

The Maquoketa Shale, Galena Dolomite, Decorah Shale, and the Platteville Formation act as a confining unit to the underlying Ordivician St. Peter Sandstone and Cambrian Jordan Sandstone, with an approximate thickness near the site of 500 feet. The combined thickness of the St. Peter-Jordan confined aquifer is approximately 150 feet in the vicinity of the subject site. Well yields from the aquifer are up to 500 gal/min.

The St. Peter-Jordan aquifer is confined at the bottom by the St. Lawrence member of the Trempealeau Formation and the Franconia Sandstone. The confining St. Lawrence-Franconia thickness in the area of the site is estimated to be 100 feet. Underneath the Franconia Sandstone, extending to the Precambrian basement rocks, is the deepest aquifer in the area comprised of the Galesville, Eau Claire, and Mt. Simon Sandstones. This aquifer is considered to be the most productive aquifer in the area with wells yielding hundreds of gallons per minute.

The Pre-Cambrian basement rocks are a complex of dense, crystalline rocks that are nearly impermeable and yield little to no water to wells.

2.1.2.2 Groundwater Flow

Regional groundwater flow in the area is to the east toward Lake Michigan with an approximate regional gradient of 0.001 ft/ft. Groundwater flow in the unconsolidated surficial sediments most likely does not mirror regional conditions and is dependent on localized geologic deposits, confining conditions, topography, and shallow well pumping. The depth to groundwater has not been determined in the vicinity of the subject site, but may be on the order of ten to tens of feet below ground surface. Due to the proximity of the site to Lake Michigan, groundwater flow is expected to be east.

Recharge rates for the aquifer system have been estimated to range from 1.4 to 8 in/yr which corresponds to approximately 3 to 24 percent of the average annual precipitation for the region.

2.1.2.3 Groundwater Use and Quality

Groundwater quality in the area has not been sufficiently documented. The shallow surficial deposits and Silurian Dolomites are susceptible to contamination from a variety of sources including underground storage tanks, agricultural runoff, and surface spills. The deeper confined bedrock aquifers are not as susceptible to contamination due to the presence of thick confining units.

Groundwater in the region is used for industrial and agricultural purposes as well as potable water supplies for individuals and municipalities. Ground water in the vicinity of the site is primarily used for industrial purposes. Well logs for the area indicate that the only wells are used for industrial purposes. These wells were installed to depths of 56 to 1680 feet. The 1680 foot high capacity well was installed in 1934 at the (then) Rahr Malting Company. The well was apparently plugged and abandoned after saltwater was found in the deep sandstone deposits.

2.2 Climate and Air Quality

Several factors control the climate of the Great Lakes region. The most important of these are a) latitude, b) continental location, c) large-scale circulation patterns, and d) the lakes themselves. The Great Lakes are large enough to have significant impacts on local weather. Overall, the region can be described as having warm summers and cold winters. Average daily summer temperatures range from daytime highs of 77.7°F to nighttime lows of 56.9°F. Average daily winter temperatures range from daytime highs of 29.0°F to nighttime lows of 13.0°F. The average annual temperature is 45.1°F.

The average summer temperature is 67.3°F and the average maximum summer temperature is 77.7°F. In winter, the average temperature is 21.0°F and the average minimum temperature is 13.0°F. Yearly, daily maximum temperatures will exceed 90°F an average of 5.1 times while daily minimum temperatures will be below 32°F an average of 142 times. Record temperatures range from 105°F (July 11, 1936) to -29°F (February 10, 1899).

2.2.1 Precipitation

Average historical precipitation data for the period from 1961 to 1990are presented in Table 2-1. Total annual precipitation averages 29.11 inches while historic extremes range from a maximum of 46.4 inches in 1959 to a minimum of 19.5 inches in 1901. Annual snowfall averages 26.8 inches with an all-time high of 75.8 inches in 1951.

2.2.2 Wind

Based on a 45-year database compiled by the State Climatologist, the overall average wind speed from the nearest National Weather Service Station (Green Bay) is 9.9 mph. Figure 8 is a wind rose for Green Bay, Wisconsin showing annual wind frequency by percent. The predominant wind directions are westerly (10%), southwesterly (10%), and south southwesterly (9%).

2.2.3 Existing Air Quality

2.2.3.1 Ambient Air Quality Standards

The Clean Air Act required the U.S. EPA to establish National Ambient Air Quality Standards (NAAQS) for air pollutants that may be injurious to public health or welfare. NAAQS have been established for six criteria air pollutants including particulate matter less than 10 microns in size (PM_{10}) , sulfur dioxide (SO_2), nitrogen oxides (NO_x), ozone (O_3), carbon monoxide (CO) and lead (Pb). In addition, Wisconsin has a secondary or welfare based standard for particulate matter (PM). Primary standards have been established to protect public health while the secondary standards have been established to protect public welfare and the environment. Criteria air pollutants are regulated by the Wisconsin Department of Natural Resources. All counties in the State are either classified as attainment (i.e. the ambient air has less of that pollutant than the standard allows) or non-attainment (i.e. ambient air has more of that pollutant than allowed by the standard). The ambient air quality standards are codified under NR 404, Wis. Adm. Code, and are summarized in Table 2-2.

2.2.3.2 PSD Increments

In addition to the NAAQS, the Prevention of Significant Deterioration (PSD) program under 40 CFR Part 52 and NR 405, Wis. Adm. Code has established maximum allowable ambient air “increments”. These increments were established at approximately 20 – 40% of the primary or secondary standard, and were intended to limit the deterioration of air quality in a PSD region. Once a PSD source is permitted in a given county, the PSD baseline is established. If the PSD baseline has been established for a pollutant by another source, all new projects, including minor sources, are required to limit their maximum ambient air impacts to levels below the PSD increments. Manitowoc County is a PSD county and the baseline has already been established for total suspended particulate matter (TSP) and SO_2. Therefore, the concentrations of these air pollutants from the proposed project are subject to the corresponding PSD increment limits. The PSD increment levels are also summarized in Table 2-2.

Table 2-1. Precipitation and temperature data from 1961 to 1990 for Manitowoc.

MONTH	Temperature Data, °F			Precipitation Data, Inches			
				Rainfall		Snow	
	Max	Min	Mean	Mean	High	Mean	High
Jan	26.2	9.7	17.9	1.3	4.3	7.9	23.0
Feb	29.8	13.3	21.6	1.2	3.6	6.7	24.0
Mar	39.5	23.7	31.6	2.0	5.2	7.1	26.3
Apr	52.4	34.0	43.2	2.7	7.7	0.8	6.5
May	64.9	43.4	54.1	2.8	8.6	0.0	1.0
Jun	74.9	52.6	63.8	3.1	8.5	0.0	0.0
Jul	80.1	59.6	69.8	3.0	12.9	0.0	0.0
Aug	78.1	58.4	68.3	3.3	11.1	0.0	0.0
Sep	70.1	51.1	60.6	3.4	12.6	0.0	0.0
Oct	58.0	40.9	49.5	2.3	6.0	0.0	0.0
Nov	44.3	29.6	37.0	2.3	7.7	1.0	18.3
Dec	31.1	16.0	23.6	1.8	4.5	7.7	20.5
Annual	54.1	36.0	45.1	29.1	46.3	26.8	75.8

2.2.3.3 Existing Air Quality

Areas are classified as either attainment or non-attainment based on ambient air quality data collected at monitoring sites around the State. Manitowoc County is classified as attainment for all pollutants *except ozone*. Manitowoc County is classified as moderate non-attainment for ozone. The criteria pollutant background concentrations for Manitowoc County are also summarized in Table 2-2.

Table 2-2. Criteria air pollutant background concentrations, PSD increments, and National Ambient Air Quality Standards for Manitowoc County.

Parameter	Averaging Period	Manitowoc County		NAAQS ($\mu g/m^3$)
		Background Concentration ($\mu g/m^3$)	PSD Increment Level ($\mu g/m^3$)	
Total Suspended Particulate (TSP)	24-Hour	74.0	n/a	n/a
Particulate Matter <10 microns (PM_{10})	Annual	23	17	50
	24-Hour	60	30	150
Sulfur Dioxide (SO_2)	Annual	9.3	20	80
	24-Hour	41.2	91	365
	3-Hour	197.5	512	1,300
Carbon Monoxide (CO)	8-Hour	2,527.4	Not Established	10,000
	1-Hour	3,475.2		40,000
Nitrogen Oxides (NO_x)	Annual	17.9	Not Established	100
Lead (Pb)	Calendar Quarter	0.05	n/a	1.5

2.3 Surface Water Resources

The major surface water resources in the vicinity of the site include the Manitowoc River and Lake Michigan.

2.3.1 Manitowoc River

The Manitowoc River is characterized as a warm-water fishery. It begins in Fond du Lac and Calumet Counties and flows eastward through central Manitowoc County and into Lake Michigan in the City of Manitowoc. According to USGS data, the River drains 526 square miles. The mean river flow over the past 20 years is 337 ft^3/sec (151,000 gallons per minute), with a maximum recorded flow of 2000 ft^3/sec (900,000 gpm).

The predominant land uses in the watershed are agriculture and forestry although urbanization is occurring, and several dams are located on the Manitowoc River. Non-point source water pollution is a major issue in the basin with soil erosion and excess nutrients impacting fish, wildlife and water quality. The Manitowoc River also has a PCB contamination problem, especially in the Manitowoc Harbor area. The lower Manitowoc River has undergone extensive alteration, including filling behind bulkhead lines, and dredging is common. The WDNR uses the lower stretches of the river to stock thousands of trout and salmon each year for its Lake Michigan Fisheries program.

2.3.1.1 Native Aquatic Species

Limited information on native species is available in the lower section of the Manitowoc River. Fyke net surveys in the late 1970's and mid-1980's identified numerous native species including northern pike, smallmouth bass, channel catfish, white and redhorse suckers, yellow perch, black crappie, pumpkinseed, rock bass, trout-perch, common shiner, common carp, bullhead, rainbow smelt, and stocked species including rainbow, brook and brown trout. The Manitowoc River plays an important role in the Lake Michigan fishery. It is considered an important location for trout and salmon stocking as wells as for spawning sites for migrations of trout, suckers, alewife and smelt (Hogler, 1999).

2.3.1.2 Fish Consumption Advisories

Several fish species are listed in the Fish Health Advisory with consumption restrictions (WDNR 1999). The 2000 Fish Advisory lists the Manitowoc River from the mouth up to the dam at Clarks Hills as containing certain fish species that are advised to be eaten either 1. No more than one meal per week, 2. No more than one meal per month, 3. No more than one meal every two months, or 4. Not to be eaten. The Advisory lists channel catfish, smallmouth bass and northern pike as being under this advisory for varying consumption rates. A note at the bottom of the Manitowoc River section states "Follow the Lake Michigan PCB advisory for trout and salmon."

The 2000 Fish Advisory for Lake Michigan and its tributaries up to the first dam including the Manitowoc River lists numerous species advisories, including chinook salmon, coho salmon, brown trout, lake trout, rainbow trout, yellow perch, whitefish, chubs, and smelt. The Advisory does not list Lake Michigan or the Manitowoc River in the mercury advisory section.

2.3.2 Lake Michigan

Lake Michigan is the second largest Great Lake by volume and the only Great Lake located totally within the United States. The northern part, including the Manitowoc area, is in the colder less developed upper Great Lakes region. It is sparsely populated, except for the Fox River Valley, and is primarily covered with mixed wood forest. The more temperate southern basin is the most urbanized area in the Great Lakes system and includes the Milwaukee and Chicago metropolitan areas. Southern-soils are typically fertile and amenable to agriculture.

The Lake's drainage basin covers more than 45,000 square miles and drains parts of four states including Wisconsin, Illinois, Indiana, and Michigan. Lake Michigan discharges into Lake Huron through the Straits of Mackinac at a rate that allows for a complete change of water about every 100 years. The Lake forms a link in a waterway system that reaches east to the Atlantic Ocean and south through the Mississippi River to the Gulf of Mexico. Among the large rivers that enter the Lake are the Fox and the Menominee in northeast Wisconsin, the St. Joseph, the Kalamazoo, and the Grand in southwest Michigan.

Table 2-3. Lake Michigan statistics.

Lake Michigan Statistics	
Length:	307 miles
Width:	118 miles
Surface Area:	22,300 square miles
Depth:	925 feet maximum depth 279 feet average depth
Volume:	1,180 cubic miles
Shoreline:	1,660 miles largely sand & pebble beaches

2.3.2.1 Resources of the Lake Michigan Basin

The Lake Michigan region supports a wealth of biological diversity, including many plant and animal species found nowhere else in the world. Lake Michigan basin's sand dunes, coastal marshes, tallgrass prairies, savannas, forests, and fens all provide essential habitats for this diversity of life. Agricultural and industrial products such as iron ore, coal, limestone, metals, petroleum, coke, and chemicals are derived from the basin's resources. Lake Michigan supports large commercial and sport fishing industries, provides industrial process and cooling water, and water for agricultural irrigation. Fleets of freighters pass over the Lake carrying bulk commerce items. Lake Michigan also serves as a source of drinking water for many cities, including Manitowoc.

2.3.2.2 Aquatic Species

Lake Michigan is considered as a cold-water fishery by the Wisconsin Department of Natural Resources for its ability to support cold-water species as well as cool-water species. The cold-water species include four trout species, Brook, Brown, Rainbow and Lake Trout, and two salmon species, Chinook and Coho Salmon, and numerous pelagic forage species. The cool-water species include numerous gamefish, panfish and minnow species mainly in the near-shore or harbor areas. Brook Trout and Lake Trout (both of which are actually chars, of the genus *Salvelinus,* not trout, genus *Salmo*) are indigenous to Lake Michigan. The other trouts and all of the salmons are non-native, non indigenous fish introduced in the past century. These native and non-native fish were stocked after the collapse of native stocks, and are important to maintaining an ecological balance in the Lake between predators and forage fish as well as being the basis of a multi-million dollar fishery.

The Lake Michigan water resource is a very complex and diverse ecosystem. In general, the cold-water fishes including salmon, trout, and pelagic forage species use the near-shore areas or tributaries for spawning, rearing or feeding purposes. Water level and temperature conditions are important factors in the utilization of the near-shore areas and tributaries by the cold-water species.

The cool-water species generally utilize the near-shore area and tributaries and do not normally use the deeper Lake Michigan basin or open water areas. In a conversation Steven Hogler, a Wisconsin Department of Natural Resources Fish Manager, stated that the near-shore areas contain yellow perch, smallmouth bass, northern pike and various minnow or forage species, as well as periodic cold-water species. Water temperature, wind direction and the presence of forage species are factors influencing the use of the near-shore areas.

2.3.2.3 Reefs, Spawning Areas, and Other Important Habitat

The nearshore area of Lake Michigan near the proposed site is a relatively shallow, flat area with a very gradual slope of approximately 6 feet in depth in 1,000 feet of distance. Unfortunately, there is very little information available on potential habitat at this location. A review of information from the Marine Studies Center, Sea Grant Institute at the University of Wisconsin – Madison indicates that 5 spawning areas were identified in Lake Chart 14903 which covers the Manitowoc and Two Rivers area. Chart 8 from the NOAA Lake Survey is included as Appendix F. This chart indicates that no spawning areas were identified within 4 miles north or south of the proposed site.

2.4 Existing Biological Environment

2.4.1 Terrestrial Vegetation, Wildlife, and Habitat

2.4.1.1 Proposed Plant Site

The site is a disturbed industrial setting. The dominant terrestrial plant community at the site consists of pioneer or invasive forb, shrub and tree species common in an industrial or other highly disturbed setting. The species identified at the site include: chicory, Queen Anne's lace, white heath aster, giant goldenrod, tall goldenrod, tansy, Canada thistle, garlic mustard, reed canary grass, raspberry, common mullein, box-elder, red osier dogwood, green ash, paper birch, and cottonwood.

The animal species observed included a few common songbirds. The visual track observations indicate that cottontail rabbit and raccoon are present at times on the site.

2.4.1.2 Proposed Once Through Cooling System Outfall Site

The proposed site for the once through cooling system outfall is located approximately 300 feet south of the City of Manitowoc Wastewater Treatment Plant site. This lakeshore site is also a disturbed setting. As with the proposed plant site itself, the dominant terrestrial plant community consists of pioneer or invasive forb, shrub and tree species common in highly disturbed settings. The species identified at the lakeshore site include Common horsetail, Queen Anne's Lace, Lakes flat-topped goldenrod, Sandbar willow, Eastern cottonwood, New England aster, Rough-leaved goldenrod, Giant ragweed, Common cocklebur, Dock, Common yarrow, Red-osier dogwood, Shining willow, Pennsylvania smartweed, Butter-and-eggs, Evening lychnis, and Spurred gentian. These are common "pioneer" species that one would expect to find in any newly exposed area. None of the species identified are threatened or endangered. They are all common with many of them being upland type invader species or "weeds".

2.4.2 Wetlands, Streams, and Aquatic Resources

There are no wetland areas in the proposed construction area identified on the Wisconsin Wetland Inventory Map and no wetland areas were identified by the Applied Environmental Sciences' biologist on or near the site during a site visit. The site is, of course, located near the Manitowoc River and Lake Michigan as stated in Section 2.1.5.

In 1998, the Institute for Environmental Studies at the University of Wisconsin – Madison completed a comprehensive study and report titled "The Coastal Wetlands of Manitowoc County, Inventory, Assessment and Management Recommendations". No wetlands were identified in the area of the proposed site.

2.4.3 Threatened and Endangered Species and Habitats

2.4.3.1 Federally Listed Species

The F&WS stated that one federally listed species, the Pitcher's thistle (Cirsium pitcheri) or sand dune thistle, occurs in Manitowoc County. The habitat for the Pitcher's thistle is stabilized dunes and blowdown areas. The FWS concluded that due to the location of the proposed power plant, this species will not be affected by the project. A review of the proposed site confirmed that neither the Pitcher's thistle nor suitable habitat for this federally listed species exists on the proposed site.

2.4.3.2 Wisconsin Natural Heritage Inventory

The Wisconsin Department of Natural Resources, Bureau of Endangered Resources response stated that the Natural Heritage Inventory data files contain no recent occurrence records of Endangered, Threatened, or Special Concern species or natural communities, nor any State Natural Areas in the project area. A copy of Applied Environmental Sciences' request letter and a copy of the WDNR response letter is also included in Appendix C.

A pair of peregrine falcons, a state endangered species, have been successfully nesting on a platform on the Busch Agricultural Products Building No. 47 for two or three years (James Crawford, WDNR, Personal communication). Peregrines have been nesting successfully on power plant boiler house roofs and stacks for many years without any documented adverse impacts.

2.5 Existing Site Aesthetics

As noted in Chapter 1, the proposed site is a vacant industrial site with abandoned railroad tracks and an abandoned foundry building in the City of Manitowoc. From the USGS topographic map in Figure 1, the site has an elevation of 583.6 to 587.7 ft above mean sea level. The proposed site and surrounding area have relatively flat terrain. This site is bordered on the east by Lakeview Drive and the City of Manitowoc Wastewater Treatment Plant, on the north by the C. Reiss Coal Company, and on the west by the Wisconsin Central Rail corridor and the Busch Agricultural Products facility. Figures 2a and 2b are photos of the existing site showing the existing rail corridor and neighboring industries. Figure 3 is a general power plant layout for this plant, and also shows the power plant location relative to the Busch Agricultural Products facility, the C. Reiss Coal Company, and other facilities.

The site has a grassy strip, numerous dirt piles, railroad tracks, and four structures on site including a machine shop, warehouse, storage shed, and pump house. These structures would be removed during this project.

2.6 Existing Noise Levels

The proposed site is zoned I-2 Heavy Industrial. The City of Manitowoc does not currently have any noise ordinances for areas zoned I-2 Heavy Industrial.

Michael Theriault Acoustics, Inc. conducted a Sound Level Evaluation for the proposed ESM-EC in June and July, 2000. This report is attached as Appendix A. An ambient sound level survey was conducted from June 24 to June 26. Sound level measurements were collected at the nearest residences and commercial or industrial receivers at the following locations:

LOCATION	DESCRIPTION	LAND USE
1	The Inn on Maritime Bay	Commercial
2	Manitowoc Public Library	Commercial
3	Intersection of 10th and Marshall Street	Residential
4	Intersection of Marshall and Lake Street	Residential
5	Intersection of 8th and Madison Street	Residential
6	City of Manitowoc Wastewater Treatment Plant	Industrial

These locations are shown in Figure 3 of the report. The study concluded that the L_{90} background noise levels averaged about 50 dBA at these sites [5]. The report also found that the long term monitoring east of Site 4 had an L_{DN} of 57 dBA[6]. The report noted that background noise levels are largely influenced by existing industrial mechanical noise, and, to a lessor extent, by local traffic.

Existing noise levels, and how a given individual may perceive them, may be difficult to describe. Typical sound pressure levels for various common sounds are summarized in Table 2-4.

[5] The L_{90} is the sound level exceeded 90% of the time and is often called the background sound level. Only 10% of the time are measured values lower than this level, so that L_{90} represents the environment at its quietest moments.

[6] The *Day-Night Level*, or L_{DN} is a single number which represents a 24-hour sound level within a community. The L_{DN} is calculated by adding a 10 decibel "margin" to sounds that occur between 10:00 pm and 7:00 am to account for increased sensitivity in residential areas when individuals are resting or sleeping.

Table 2-4. Typical noise sources and sound intensity levels.

Sound level		Example
dB	Intensity, w/m^2	
130	10	Threshold of *feeling*.
120	1.0	Jet aircraft at 40 meters
110	0.1	Orchestra at 5 meters
100	0.01	Riveting at 10 meters
90	0.001	Inside tube train
80	0.0001	Noisy office
70	10^{-5}	Motor car at 5 meters
60	10^{-6}	Normal speech at 1 meter
50	10^{-7}	Average office.
40	10^{-8}	Quiet office
30	10^{-9}	Public library
20	10^{-10}	Whisper at 2 meters
10	10^{-11}	Quiet whisper at 1 meter
0	10^{-12}	Threshold of audibility

2.7 Existing Human Environment

2.7.1 Archaeological and Historic Sites

To determine if any significant cultural or historical resources are located on the proposed site, Mr. Robert P. Fay, an archaeologist with Old Northwest Research, conducted a Phase I archaeological survey of the site in October and November, 1999. The historical research and archaeological field investigation by Mr. Fay resulted in the following findings:

1. No evidence of prehistoric or historic Native American occupation or use of the property.
2. Several historic materials and debris of recent origin were found during surface inspection.
3. A total of 426 artifacts dating from the modern period were found during shovel testing.
4. Four buildings exist on the site that no longer retain historic or architectural integrity for nomination to the National Register of Historic Places.
5. Heavily disturbed soils resulting from previous industrial land use activities including railroad track construction, coal dock operations, shipping and storage, underground utilities, and other recent land use activities.

Based on these findings, Mr. Fay concluded that the proposed site warrants no further archival, historic, or archaeological research. The Archaeology Survey Report is available in the EIR submitted by the applicant.

2.7.2 The City of Manitowoc Municipal Services

The City of Manitowoc is organized under a Mayor/Common Council form of government. It has a comprehensive city plan and city zoning ordinances are in effect. The city has a fire department and police force consisting of 49 full-time firefighters and 64 full-time police officers. The city also operates an industrial waste pick-up service and public library. There are seventeen family daycare centers and eighteen group daycare centers. The community has 35 churches and one synagogue. There are four motels, two hotels, eight national chain retail stores, eight banks, and five credit unions. In addition, there are two city newspapers, one daily and one biweekly.

Various modes of transportation serve the community including rail service, motor carriers (including city buses and paratransit), port service, and air service. While Manitowoc County does have an airport, the nearest commercial air service is 38 miles away at the Austin-Straubel Airport in Green Bay.

Utilities are provided by several suppliers in the City of Manitowoc. Manitowoc Public Utilities is responsible for providing electric and water service while the City of Manitowoc provides sewage treatment capabilities. Natural gas is supplied by the Wisconsin Fuel & Light Company.

2.7.3 Current Land Use and Zoning

The proposed site is currently a vacant industrial site and rail corridor. The proposed site is zoned I-2, Heavy Industrial, and is currently owned by the Wisconsin Central Railroad. The site is bordered on the east by Lakeview Drive (U.S. Highway 10), on the west and south by Wisconsin Central Railroad corridor and the Busch Agricultural Products facility, and on the north by the C. Reiss Coal Company unloading/storage power plant, docks and boat slip. The Lake Michigan Car Ferry Service ticket office and parking lot are located just northeast of the property site.

2.7.4 Recreational Areas

There are four community parks, four community playfields, eight neighborhood parks, six neighborhood playgrounds, three mini parks, and eleven special use facilities in the Manitowoc community. The Lincoln High School and the Red Arrow Park are located approximately three quarters of a mile south of the proposed site. There are many activities available at these parks, which include picnic areas, play apparatus, baseball diamonds, football fields, basketball courts, tracks, tennis courts, ice skating rinks, and one with a swimming pool.

2.7.5 Manitowoc, Wisconsin Community Profile

The City of Manitowoc encompasses approximately 15.8 square miles on the western shore of Lake Michigan. Since 1990, Manitowoc has grown by approximately 0.93 square miles (6.3%). The following sections describe various aspects of every day living in the City of Manitowoc.

2.7.5.1 Education

There are twenty-four public and private schools from preschool to high school in the City of Manitowoc. The total number of students enrolled is approximately 8,000. There is one technical college within 50 miles of the City of Manitowoc that has approximately 2,500 students. Manitowoc students consistently rank at or above the State averages and above national averages for the ACT and SAT tests. The high school graduate rate is at 92.8%, slightly above the state graduation rate of 91.1%.

2.7.5.2 Cost-of-living

Based on ACCRA (www.ACCRA.org) reports where 100 is the average cost of living in the United States, the City of Manitowoc has the following relative costs:

Housing	118.1
Utilities	93.5
Transportation	95.7
Health	99.8
Groceries	103.3
Misc. goods and services	96.4
Composite	**103.2**

The estimated median household income in 2000 for the City of Manitowoc is $27,286. In 1989, 10.7% of the population in the City of Manitowoc was living below the poverty level.

2.7.5.3 Labor

The size of the labor force is approximately 16,450 in the city and 43,000 in the county. Of this number approximately 15,700 and 41,300 are presently employed in the city and county, respectively. There are 30,589 people who are 16 and older. Of this population, 0.13% are employed in the armed forces, 58.78% are employed citizens, 3.52% are unemployed citizens, and 37.56% are not in the labor force. The median starting wage rate for all industries in the community is $8.25 per hour and median wage is $10.28 per hour.

2.7.5.4 Employers

The top ten employers in the City of Manitowoc employ approximately 7,900 workers. Table 2-5 identifies the top ten employers and the number of employees at each for the year 1996.

Table 2-5. Top Ten Employers for the City of Manitowoc, Wisconsin.

Employer	Number of Employees
Mirro	1,700
Holy Family MMC	1,000
Manitowoc County	996
Manitowoc Company	989
MTWC School District	900
Dayco/Imperial Eastman	617
Goetze	574
City of Manitowoc/MPU	450
Lakeside Foods	340
ECK Industries	330

2.7.5.5 Demographics

Approximately 34,134 and 83,828 people live in the City of Manitowoc and Manitowoc County, respectively. These numbers represent a population increase of 4.96% and 4.24% between 1990 and 1997 in the city and county, respectively. With a city area of 15.78 square miles, Manitowoc has an average population density of 2,160 persons per square mile.

Race and ethnicity data for Manitowoc County are given in Table 2-4. This data indicates that Manitowoc County is primarily a white (non-Hispanic) population. The population by age is summarized in Table 2-6.

Table 2-6. Race and ethnicity data for Manitowoc County, Wisconsin.

	1990 CENSUS		1995 UPDATE		2000 FORECAST	
	Number	%	Number	%	Number	%
White	78,730	98	80,232	97	81,606	97
Black	115	0	140	0	177	0
Asian/Pacific	1,071	1	1,733	2	2,345	3
Other Races	505	1	424	1	409	0
Hispanic (any race)	582	1	672	1	771	1

SOURCE: City of Manitowoc Planning Office, July 1996.

On July 13th, Applied Environmental Sciences contacted the City of Manitowoc Planning Office to inquire regarding the potential for a disproportionate representation of persons of specific ethnic or age classes in the immediate area of the proposed ESM-EC. While Mr. Nicholas Lebendusky of the City of Manitowoc Planning Office indicated that there are some limited clusters of primarily Asian/Pacific and Hispanic peoples within the City of Manitowoc, he was not aware of any disproportionate representation of minority or age populations in the area.

2.7.5.6 Health

There is one hospital, Holy Family Memorial Medical Center, and eleven medical clinics serving the Manitowoc area. There are approximately fifty M.D.s, six D.O.s, and twenty-five dentists in the community. The specialties covered in the clinics include dental, optometrist, surgery, internal medicine, obstetrics, pediatrics, family practice, urology, dialysis, and ear and throat. There are seven nursing homes in the community with a total of 917 beds.

Table 2-7. Population by age for Manitowoc County, Wisconsin.

AGE	1990 CENSUS		1995 UPDATE		2000 FORECAST	
	Number	%	Number	%	Number	%
0-4	5,636	7	6,053	7	5,861	7
5-14	12,427	15	12,337	15	12,156	14
15-19	5,330	7	5,859	7	6,402	8
20-24	4,895	6	4,869	6	5,204	6
25-34	12,385	15	10,953	13	10,003	12
35-44	11,482	14	12,687	15	12,647	15
45-64	15,464	19	16,689	20	19,198	23
65-74	6,803	8	6,856	8	6,559	8
75-84	4,518	6	4,545	6	4,566	5
85+	1,481	2	1,681	2	1,941	2

SOURCE: City of Manitowoc Planning Office, July 1996.

2.7.5.7 Housing

There are an estimated 17,500 households in Manitowoc in 2000, of which 70% were owner occupied and 30% were renter occupied. Of these houses, 96% are occupied and the remaining 4% are vacant. The median property value is $52,125, as provided by the City of Manitowoc Planning Office, July 1996.

2.7.5.8 Retail Sales

The annual retail sales for the City of Manitowoc is approximately $348 million dollars. Table 2-8 includes a breakdown of the expenditures.

Table 2-8. Retail Spending for the City of Manitowoc, Wisconsin.

Type of Spending	Annual Retail Sales, Millions of Dollars
Food Stores	$63
Eating & Drinking Places	$34
Drug & Proprietary	$37
Gasoline Service Station	$23
General Merchandise	$47
Apparel & Accessory	$16
Furniture, Furnishings & Equipment	$17
Automotive Dealer	$83
Hardware, Lumber & Garden	$19
Total Retail Sales	**$348**

SOURCE: Equifax National Decision Systems, Feb. 2, 1996.

2.7.6 Economic Development

The total market value of all taxable property in the city (January 1, 1997) was $1,161,522,400. The total market value increased by 7.3% over 1996 levels. Of the total market value, 9% was manufacturing real estate and 72% was residential real estate. The total market value of manufacturing real estate property was $99,035,100.

The standard overhead costs of doing business in Manitowoc include a 7.9% flat rate corporate income tax, 5% sales/use tax, and a 2.891% property tax. In addition, there are unemployment compensation, worker's compensation, personal income, and capital gains taxes and fees. There are also general city, state, county, school, and VTAE taxes.

2.7.6.1 Vacant and Industrially-Zoned Land

In the City of Manitowoc, there are at least twelve individual parcels of land that are either vacant or industrially zoned, including the proposed site. These land parcels range from 0.64 acre to 49.92 acres in size. The City of Manitowoc owns and maintains the "I-43 Industrial Park". The industrial park is located at the northwest corner of I-43 and USH 151 and is currently being developed.

2.7.6.2 City-Wide Trends

Since 1990, the city has consistently issued building permits each year in the range of 1,372 (1990) to 1,665 (1997). During this same time period, with the exception of 1992 (-3.54%), total manufacturing value has increased in a range of 0.04% (1997) to 5.04% (1995).

2.7.7 Landfills and Waste Disposal Services

Manitowoc County has one major landfill located within approximately 10 miles of the proposed site. The Waste Management of Wisconsin Ridgeview Recycling and Disposal, WDNR I.D. Number 4360020530, is an approved landfill operating under Wisconsin License Number 03041. In the landfill operator's recent submittal to the DNR, the landfill indicated the following waste disposal categories and amounts in 1999:

WASTE CATEGORY	1999 Disposal, tons
Municipal Solid Waste	340,792
Ashes and Sludges from Electric and Process Steam Generating Facilities	31,042
Pulp or Paper Mill Sludges	33,223
Manufacturing Solid Wastes from Foundries	70,740
Sludges from Municipal Wastewater Treatment Plants	1,320
All Other Solid Wastes	69,324
Waste Used as Daily Cover	88,211
High Volume Waste Used as Daily Cover	150,319
TOTAL	**784,970**

Based on the 1999 disposal rates and an estimated remaining site capacity of 5,062,000 cubic yards, the landfill operator estimated a remaining site life of 6.3 years.

2.7.8 Roads and Railroads

The City of Manitowoc Engineering Department was contacted on May 19, 2000 concerning traffic volume near the proposed power plant. According to the department, the nearest traffic study area was on South 8th Street between Washington Street and Marshall Avenue and on South 7th Street between Washington Street and Marshall Avenue. The study, conducted in 1999, counted 2500 vehicles per day on South 8th Street and 760 vehicles per day on South 7th Street. The counts were not subdivided into specific vehicle types.

Applied Environmental Sciences contacted the Wisconsin Central Railroad Limited office in Des Plaines, Illinois on May 19, 2000 for an estimate of railcar traffic in the area. According to information received, about 60 to 70 railcars travel on the rail spur near the power plant each way per day for a total traffic count of 120 to 140 cars per day.

The United States Coast Guard Marine Safety Division – Manitowoc, Wisconsin was contacted on May 19, 2000 concerning barge traffic in the Manitowoc area. The office was not aware of records kept concerning barge traffic in that area.

Chapter 3. Environmental Impacts of the ESM Energy Center

3.1 Air Quality Impacts

3.1.1 Projected Criteria Air Emissions

Potential emissions from the proposed project are estimated based on the worst-case operating scenarios taking into account control equipment and federally enforceable conditions expected to be in the power plant's permit. Potential project emissions are summarized in Table 3-1 based on the above assumptions.

Table 3-1. Control technologies and emissions for the ESM Energy Center.

PSD POLLUTANT	BEST AVAILABLE CONTROL TECHNOLOGY	POTENTIAL TO EMIT, tons per year	SIGINICANT LEVEL, tons per year
1. Carbon Monoxide (CO)	CFB Boiler Technology **and** Good Combustion Practices	512	100
2. Nitrogen Oxides (NO_x)	CFB Boiler Technology **and** SNCR	326	40
3. Particulate Matter and PM_{10}	CFB Boiler Technology **and** Fabric Filter (FF) Baghouse	51	25
4. Sulfur Dioxide (SO_2)	CFB Boiler Technology **and** Dry Flue Gas Desulfurization with FF Baghouse	931	40
5. Volatile Organic Compounds	CFB Boiler Technology **and** Good Combustion Practices	39	40
6. Lead (Pb)	CFB Boiler Technology **and** FF Baghouse	0.51	0.60
7. Mercury (Hg)	CFB Boiler Technology **and** FF Baghouse	0.09	0.10
8. Fluorides	CFB Boiler Technology **and** SO_2 & PM Control Systems	2.8	3.0
9. Sulfuric Acid Mist	CFB Boiler Technology **and** SO_2 & PM Control Systems	12.1	7.0

As a result of these potential emissions the proposed project will be classified as a major source under both the operation permits program in NR 407, Wis. Adm. Code, and New Source Review programs under NR 405 and NR 408, Wis. Adm. Code.

3.1.2 New Source Review Requirements

The Clean Air Act Amendments of 1997 established a national permitting program for all areas of the country. Areas in which the air quality meets the National Ambient Air Quality Standards (NAAQS) are subject to Prevention of Significant Deterioration (PSD) rules. Areas in which the air quality does not meet the NAAQS are subject to non-attainment area new source review (NSR) requirements. The analysis as to whether or not an area meets the NAAQS is done on a pollutant-by-pollutant basis.

3.1.3 Prevention of Significant Deterioration

The provisions of the PSD program apply to major new sources and major modification(s) of existing major sources being constructed in areas where existing ambient air quality meets the NAAQS. Major sources are those sources which have the potential to emit more than 100 tons per year of any one of the criteria pollutants if it is listed as one of 28 specific pre-designated categories, or 250 tons per year for all other source categories.

Because this proposed source belongs to one of the 28 pre-designated categories and will have potential emissions of at least one of the "attainment area" criteria pollutants in amounts greater than 100 tons per year, this project will be subject to PSD review. The major elements of PSD review include:

1. Control Technology Review (NR 405.08)
2. Source Impact Analysis (NR 405.09)
3. Air Quality Analysis (NR 405.11)
4. Additional Impacts Analysis (NR 405.13)

3.1.3.1 Control Technology Review

All new major stationary sources must apply the best available control technology (BACT) for each air contaminant that it would have the potential to emit in significant amounts. Based on the proposed BACT limits in Table 3-1, carbon monoxide (CO), particulate matter, PM_{10}, sulfur dioxide (SO_2), and sulfuric acid mist would be emitted in quantities in excess of the PSD significant levels under NR 405.02(27)(a), Table A, Wis. Adm. Code. As a result, these pollutants are subject to the control technology review requirements of NR 405.08. However, based on the proposed limits for volatile organic compounds (VOCs), lead (Pb), mercury (Hg), and fluorides, potential emissions of these pollutants are below the PSD significant levels. As a result, this project is not subject to the control technology review requirements of NR 405.08 for VOC, Pb, Hg, and fluoride emissions.

The Clean Air Act, and NR 405.02(7), Wis. Adm. Code, define *BACT* as "…an emission limitation based on the maximum degree of reduction for each pollutant subject to regulation under the Act which would be emitted from any proposed major stationary source or major modification which the department, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes and available methods, systems, and techniques, including fuel cleaning or treatment of innovative fuel combustion techniques for control of each such pollutant. In no event shall application of BACT result in emissions of any pollutant which would exceed the emissions allowed by any applicable standard under 40 CFR 60 and 61…"

The requirements of 40 CFR 60 are the new source performance standards (NSPS) for new or modified units. These standards set the base, or minimum control requirements for BACT.

3.1.3.1.1 Standards of Performance for New Stationary Sources

The CFB boiler is subject to the standards of performance for new stationary sources under 40 CFR Part 60, Subpart Da, and NR 440.20, "Electric steam generating units for which construction commenced after September 18, 1978". In all cases, the proposed BACT levels and requested emission limits for this power plant are more stringent than the NSPS requirements of Subpart Da. The Subpart Da limitations are summarized in Table 3-2.

Table 3-2. Standards of performance for new electric steam generating units constructed after September 18, 1978 compared to the proposed BACT limits.

POLLUTANT	NSPS EMISSION LIMIT	REDUCTION REQUIREMENT	PROPOSED BACT LIMITS
Particulate Matter	0.03 lb/mmBtu	99%	0.011 lb/mmBtu
Visible Emissions	20% Opacity	N/A	20% Opacity
Sulfur Dioxide(1)			
Petroleum Coke	1.2 lb/mmBtu	90%(2)	0.20 lb/mmBtu
Distillate Oil	0.20 lb/mmBtu	0%	
Nitrogen Oxides(3)	1.6 lb/MW-hr	N/A	0.07 lb/mmBtu(3)

Footnotes

(1) NSPS SO_2 emission limitation is based on a 30-day rolling average.

(2) The NSPS emission limit varies depending upon fuel quality and establishes a 90% reduction and 1.2 lb/mmBtu limitation or 70% reduction when emissions are below 0.60 lb/mmBtu.

(3) The proposed limit is equal to 0.7 lb/MW-hr, gross output.

The materials handling and storage operations are subject to 40 CFR Part 60, Subpart Y, and NR 440.42, Wis. Adm. Code, when handling coal. However, since this facility will not be permitted to fire coal, these requirements will not apply. If these standards did apply, NR 440.42 would prohibit visible emissions of

20 percent opacity or greater from any coal processing and conveying equipment, coal storage system (except open storage), or coal transfer and loading systems. The proposed systems are designed to achieve visible emissions of 5 and 10 percent opacity. These levels are more stringent than the existing NSPS requirements.

The materials handling and storage operations, with the exception of the open storage piles and railcar or truck dumping operations, are also subject to 40 CFR Part 60, Subpart OOO, and NR 440.688, Wis. Adm. Code, when handling limestone. For these operations, the proposed BACT levels are more stringent than the NSPS requirements of Subpart OOO which are presented in Table 3-3.

Table 3-3. Standards of performance for new nonmetallic mineral processing plants for the limestone handling operations compared to the proposed emission limits.

OPERATION	NSPS EMISSION LIMITS	PROJECTED EMISSION LEVELS
Limestone Silos and Receiving Hoppers	0.022gr/dscf 7% opacity	0.009 gr/dscf 5% opacity
Limestone Dryer/Mill Building Vents & Exhaust, excluding AQCS exhaust	No Visible Emissions 0% Opacity	No Visible Emissions 0% Opacity
Limestone Dryers/Mills	0.022 gr/dscf 7% opacity	0.004 gr/dscf 5% opacity
Limestone Crusher/Conveyor Transfers	0.022 gr/dscf 7% opacity	0.004 gr/dscf 5% opacity
Limestone Conveyors, Transfer Points, and Enclosures	10% Opacity	5% opacity

Any control technology (i.e. BACT) review must include an evaluation of environmental, energy, technical, and economic impacts. Currently, the USEPA is recommending a “top-down” approach in conducting a BACT analysis. The first step in the top-down BACT approach is to determine the most stringent control available for a similar source or source category. If it is shown that the level of control is technically or economically infeasible for the source in question, then the next level of control is determined and similarly evaluated. This process continues until the technology under consideration cannot be eliminated by any substantial or unique energy, environmental, or economic impact.

The energy impact analysis estimates the direct energy impacts of the control alternatives in units of energy consumption. If possible, the energy requirements for each control option are assessed in terms of total annual energy consumption. The net environmental impact associated with a control alternative is considered through the use of computer driven air dispersion modeling analyses. The economic impact of a control option is assessed in terms of cost effectiveness. The economic impacts are reviewed on a cost per ton controlled basis, as directed by the USEPA's Office of Air Quality Planning and Standards (OAQPS) Cost Control Manual, Fifth Edition.

Once the energy, environmental, and economic impacts are assessed the level of control achieved through the use of the technology being evaluated is determined to be BACT. This top-down approach was utilized in the BACT analysis for this proposed source. Table 3-1 also specifies the control technology determined to be BACT for the CFB boiler for those air contaminants that would have the potential to be emitted in significant amounts. In addition, Table 3-1 specifies proposed limitations for other pollutants which limit those emissions to levels below the significant levels in NR 405.

3.1.3.2 Air Quality Analysis

All PSD applications must "…contain an analysis of ambient air quality in the area that the major source would affect for each air contaminant that it would have a potential to emit in a significant amount". However, sources which have ambient air quality impacts below the monitoring *de minimus* levels do not need to conduct any analysis beyond documenting this *de minimus* impact.

Table 3-4 summarizes the maximum project-only impacts for all the pollutants. From Table 3-4, the maximum project-only impacts for all pollutants are always predicted to be less than the monitoring *de minimus* levels. Significant impacts from lead, mercury, fluorides, and beryllium are all always less than the monitoring *de minimus* levels as well. Because the predicted ambient concentrations are always below *de minimus* monitoring guidelines, further ambient air quality monitoring is not necessary.

Table 3-4. Maximum air quality impacts compared to the significant impact and monitoring *de minimus* levels for the ESM Energy Center.

Pollutant	Averaging Interval	Significant Impact Level µg/m^3	Monitoring *De Minimus* µg/m^3	Maximum Project Impact µg/m^3
Nitrogen Oxides	Annual	1	14	0.37
Carbon Monoxide (CO)	1-Hour	2000	--	54.6
	8-Hour	500	575	15.6
Particulate Matter < 10	24-Hour	5	10	9.9
µm (PM_{10})	Annual	1	--	2.1
Particulate Matter (PM)	24-Hour	5		22.5
	Annual	1		4.7
Sulfur Dioxide (SO_2)	3-Hour	25	--	41.56
	24-Hour	5	13	12.91
	Annual	1	--	0.99
Lead	24-Hour	-	0.1	0.0044
Mercury	24-Hour	-	0.25	0.0008
Fluorides	24-Hour	-	0.25	0.0243
Beryllium	24-Hour	-	0.001	3.8×10^{-6}

3.1.3.3 Source Impact Analysis

All owners and operators of new major stationary sources must "…demonstrate that allowable emission increases from the proposed major source, in conjunction with all other applicable emissions increases would not cause or contribute to air pollution in violation of:

(1) Any national ambient air quality standard (NAAQS); and
(2) Any applicable maximum allowable increase over the baseline concentration (called a PSD increment) in any area."

All estimates of ambient concentrations must be based on the applicable air quality models, databases, and other requirements specified in Appendix W of 40 CFR Part 51, U.S. EPA's *"Guideline on Air Quality Models (Revised)"*.

Because the project only impacts in Table 3-4 were above the significant levels for SO_2, PM_{10}, and PM, an additional cumulative impact analysis was performed for these pollutants. The cumulative analysis considers emissions from both the proposed source and other existing or permitted sources that cause significant ambient impacts in the proposed source's significant impact area. The results from the cumulative impact analysis are used to determine compliance with the NAAQS and PSD increment requirements.

The **NAAQS compliance demonstration** is performed by adding measured existing background ambient air levels to modeled impacts from the proposed power plant and all other explicitly modeled cumulative sources in the NAAQS source inventory. The total impact is then compared to the NAAQS. Table 3-5 is a summary of the NAAQS analysis results. From Table 3-5, the maximum modeled impacts from the proposed ESM Energy Center are always less than the applicable national ambient air quality standard, or, for PM, the applicable Wisconsin standard.

Table 3-5. Summary of the air quality impact analysis for the ESM Energy Center.
(All concentrations are in units of micrograms per cubic meter, μg/m^3).

Pollutant / Parameter	PM_{10} 24-hour	PM_{10} Annual	PM 24-hour	SO_2 3-hour	SO_2 24-hour	SO_2 Annual
Maximum Cum. Concentration	74.4	18.2	74.4	570.8	184.0	16.1
Background Concentration	60	23	74	197.5	41.2	9.3
Total Concentration	134.4	41.2	148.4	768.3	225.2	25.4
NAAQS Standard	**150**	**50**	**150**	**1300**	**365**	**80**
% of NAAQS	89.6%	82.4%	98.9%	59%	62%	32%
Impact Distance, meters[a]	412	313	412	2042	3400	3400
Impact Direction [a]	NNW	N	NNW	SW	SW	SW
Impact UTM Easting, m	447560	447674	447560	446660	445660	445660
Impact UTM Northing, m	4882128	4882041	4882128	4879978	4878978	4878978

[a] Distance and direction from stack S01.

The **PSD increment compliance demonstration** is performed by modeling actual emission changes that have occurred since the minor source baseline date. The total ambient air quality concentration change is then compared to the applicable PSD increment. Table 3-6 is a summary of the PSD increment analysis results. As with the NAAQS analysis, the maximum modeled impacts for the proposed ESM Energy Center are always less than the applicable PSD increments.

Table 3-6. Cumulative class II increment analysis for the ESM Energy Center. (All concentrations are in units of micrograms per cubic meter, $\mu g/m^3$).

Pollutant/ Parameter	PM_{10} 24-hour	PM_{10} Annual	SO_2 3-hour	SO_2 24-hour	SO_2 Annual
PSD Class II Increment Concentration	30	17	512	91	20
Maximum ESM-Only Concentration	9.4	2.0	39.1	8.7	0.55
Percent of Class II Increment	31.3%	11.8%	7.6%	9.6%	1.1%
Maximum Cumulative Concentration	28.47	6.53	39.1	8.7	0.55
% of Class II Increment	94.9%	38.4%	7.6%	9.6%	1.1%
Cumulative Impact Distance (m)	363	355	728	1803	3717
Cumulative Impact Direction	N	N	E	NE	SW
Cumulative Impact UTM Easting	447685	447686	448360	449160	445160
Cumulative Impact UTM Northing	4882090	4882082	4881528	4882728	4878978

3.1.3.4 Additional Impacts Analysis

All applications for operation permits must, "…provide an analysis of the impairment to visibility, soils, and vegetation that would occur as a result of the major source and general commercial, residential, industrial and other growth associated with the major source." The following section summarizes the additional impacts analysis performed under the PSD program.

3.1.3.4.1 Visibility Impact

PM, NO_x, and SO_2 emissions from this power plant have the potential to impact local and regional visibility. NO_x and SO_2 emissions react in the atmosphere to form sulfate and nitrate compounds. These compounds condense as very fine particulate matter and can cause visibility impairment. However, the potential emissions of these pollutants from this power plant are a small fraction of the annual statewide emissions as discussed below. As a result, this power plant is not expected to cause any perceptible visibility impacts to the region. In addition, a Level 1 screening analysis was performed to determine potential impacts to the Rainbow Lake and Seney Wilderness areas in northwest Wisconsin. This analysis indicates that the maximum visual impacts to these Class 1 areas are less than the screening criteria.

3.1.3.4.2 Impacts to Soils and Vegetation

The primary pollutants from this proposed project are nitrogen oxides (NO_x), carbon monoxide, sulfur dioxide (SO_2), and particulate matter (PM). In addition, this power plant will be a source of trace element hazardous air pollutants, including ammonia, mercury, and other trace elements that occur in petroleum coke and limestone. The emissions and potential concentrations of hazardous air pollutants are discussed in detail in section 3.1.7 of this report.

Emissions from this power plant can cause increases in nitrate (NO_3^-) and sulfate (SO_4^-) ion deposition to soils and vegetation in the area. However, as discussed above with respect to visibility impairment, nitrate and sulfate deposition rates are regional or long range transport air pollution issues. NO_x and SO_2 emissions are normally transported 10's to 100's of miles before deposition occurs. As a result, this power plant is not expected to significantly impact nitrate or sulfate deposition rates.

The national ambient air quality standards include welfare standards intended to protect soils and vegetation from significant impacts due to deposition of these pollutants. Since this power plant has been modeled and has demonstrated compliance with the NAAQS and PSD increment requirements, significant deposition impacts are not expected. For example, background summer wet nitrate and sulfate deposition rates for northeastern Wisconsin have been estimated by the WDNR at 3.78 and 3.95 kg/hectare, respectively (0.70 and 0.73 lb/acre)[7]. If this power plant operated at 100% capacity and all emissions from this power plant were deposited uniformly in an area surrounding the plant within a radius of 200 miles, the nitrate and sulfate deposition rates would be approximately 0.008 and 0.02 lb/acre, respectively. This would represent a 1% increase in nitrate deposition and a 3% increase in sulfate deposition. Since nitrate and sulfate deposition rates are long range transport issues, this is a relatively conservative estimate of actual nitrate and sulfate deposition rates. Since this conservative analysis indicates a limited impact to nitrate and sulfate deposition rates, actual impacts are expected to be very small.

3.1.4 Acid Deposition Emissions

Air pollutant emissions from the combustion of fossil fuels are the major cause of acid deposition, or acid rain as it is commonly known. Acid deposition occurs when emissions of sulfur dioxide (SO_2) and oxides of nitrogen (NO_x) react in the atmosphere with water, oxygen, and oxidants to form various acidic compounds. This mixture forms a mild solution of sulfuric acid and nitric acid. Sunlight increases the rate of most of these reactions. Because the ESM project will combust fossil fuels, it will also emit SO_2 and NO_x.

[7] Taken from the Wisconsin Department of Natural Resources' Wisconsin Acid Deposition Monitoring and Evaluation Program, 1995 Report, Table 2.1-1b.

3.1.4.1 Sulfur Dioxide Emissions

The potential sulfur dioxide (SO_2) emissions from this power plant based on the worse-case fuel and the operation of the plant at its maximum capacity for 8,760 hours per year is 931 tons per year. For facilities of this type, normal operation is typically 75 - 90% of this maximum capacity. For comparison, the total Wisconsin utility emissions and total Wisconsin annual emissions are summarized in the table below. Note that the total Wisconsin SO_2 emissions of 303,049 tons is down 56% from the 1980 level of 686,399 tons. From Table 3-7, the *potential* emission rate from the ESM Energy Center in pounds per million Btu of heat input is only 22% of the major utility *actual* emission rate. The *potential* annual SO_2 emissions from this power plant are less than one-half of one percent of the annual actual emissions from all Wisconsin utilities combined.

Table 3-7. Wisconsin's major utility SO_2 emissions compared to the potential emissions from the ESM Energy Center.

	Emission Rate, lb/mmBtu	Annual Emissions, tons per year
Energy Services of Manitowoc	0.20	931
Wisconsin Major Utilities[1]	0.90	211,522
Total Wisconsin Emissions[1]		303,049

1. Data from the Wisconsin Department of Natural Resources' publication Wisconsin 1998 Sulfur Dioxide and Nitrogen Oxides Emission Report, PUB-AM-305-00.

3.1.5 Nitrogen Oxide Emissions

The total potential nitrogen oxide (NO_x) emissions from this power plant are 327 tons per year. The total Wisconsin utility emissions and total Wisconsin annual emissions are summarized in Table 3-8.

Table 3-8. Wisconsin's major utility NO_x emissions compared to the potential emissions from the ESM Energy Center.

	Emission Rate, lb/mmBtu	Annual Emissions, tons per year
Energy Services of Manitowoc	0.07	327
Wisconsin Major Utilities[1]	0.52	116,538
Total Wisconsin Emissions		193,795

1. Data from the Wisconsin Department of Natural Resources' publication Wisconsin 1998 Sulfur Dioxide and Nitrogen Oxides Emission Report, PUB-AM-305-00.

As indicated in Table 3-8, the NO_x emission rate from this power plant in pounds per million Btu of heat input is less than 13% of the average major utility emission rate. In addition, the potential annual NO_x emissions from this power plant are less than three tenths of one percent of the annual actual emissions from all Wisconsin utilities combined.

3.1.5.1 Federal Acid Rain Program

Title IV of the 1990 Clean Air Act Amendments established the federal Acid Rain Program (ARP) which sets as its primary goal the reduction of acid deposition through reductions in emissions of sulfur dioxide (SO_2) and nitrogen oxides (NO_X), the primary causes of acid rain. The Acid Rain Program established a system to reduce the total U.S. annual SO_2 emissions by 50% from 1980 levels. This reduction is equal to an annual reduction of 10 million tons per year. To achieve this goal at the lowest cost to society, the program employs an innovative, market-based approach for controlling air pollution. In addition, the program encourages energy efficiency and pollution prevention.

The Acid Rain Program affects existing utility units serving generators with an output capacity of greater than 25 megawatts and all new utility units. During Phase II of the program which began in 2000, the Act sets a permanent annual ceiling (or cap) of 8.95 million allowances (one allowance is equal to one ton of SO_2 emissions) for total annual allowance allocations to utilities. This cap firmly restricts emissions and ensures that environmental benefits will be achieved and maintained, even when new facilities are constructed. The Energy Services of Manitowoc Energy Center will be an affected new unit under the federal Acid Rain Program in 40 CFR Part 72 – 76. Because this power plant is a new power plant, the power plant will receive no allowances under the ARP. As a result, in order to operate this power plant, ESM will be required to buy its allowances from another power plant that has reduced its emissions below the allowances allocated in this program. As a result, even though the ESM power plant is a new power plant, the total U.S. emissions are capped so that the ESM power plant cannot add new SO_2 emissions beyond the cap.

3.1.6 Greenhouse Gas Emissions

Energy from the sun drives the earth's weather and climate, and heats the earth's surface; in turn, the earth radiates energy back into space. Atmospheric greenhouse gases (water vapor, carbon dioxide, and other gases) trap some of the outgoing energy, retaining heat like the glass panels of a greenhouse. Without this natural "greenhouse effect," temperatures would be much lower than they are now, and life as known today would not be possible. Instead, thanks to greenhouse gases, the earth's average temperature is a more hospitable 60°F. However, problems may arise when the atmospheric concentration of greenhouse gases increases.

Since the beginning of the industrial revolution, atmospheric concentrations of carbon dioxide have increased nearly 30%, methane concentrations have more than doubled, and nitrous oxide concentrations have risen by about 15%, while global temperatures have also risen. These increases may be enhancing the heat-trapping capability of the earth's atmosphere. While there is a broad scientific consensus that this is occurring, the connection between greenhouse gas emissions and other pollutant emissions is uncertain."[8] Sulfate aerosols, one of the air pollutants that this project will emit, cool the atmosphere by reflecting light back into space. However, sulfates are short-lived in the atmosphere and vary regionally[9].

Some greenhouse gases occur naturally in the atmosphere, while others result from human activities. Naturally occurring greenhouse gases include water vapor (H_20), carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and ozone. The combustion of fossil fuels in automobiles and power plants adds to the levels of these naturally occurring gases. CO_2 is a primary combustion product: About 6 billion tons of CO_2 are emitted each year from the combustion of fossil fuels (coal, oil, and natural gas). The Wisconsin DNR has estimated Wisconsin's 1990 greenhouse emissions at approximately 140 million tons with an expected annual growth rate of 1.2%. About 90% of these emissions are carbon dioxide emitted from fossil fuel combustion. The two main fossil fuel combustion sources are motor vehicles and electric utility power plants.

The primary greenhouse gas emissions from this project will be carbon dioxide (CO_2). Nitrous oxide (N_2O) would also be emitted from this project and the global warming potential for these emissions can be expressed as equivalent tons of CO_2 emissions[10]. The total potential carbon dioxide (CO_2) equivalent emissions from this power plant are 1,060,000 tons per year. This estimate is based on the worse-case fuel (petroleum coke) and the operation of the power plant at its maximum capacity for 8,760 hours per year. For facilities of this type, normal operation is typically 75 - 90% of this maximum potential capacity. The total Wisconsin utility emissions and total Wisconsin annual emissions are summarized in Table 3-9. From this Table, the potential annual CO_2 emissions from this power plant are less than 2% of the annual actual emissions from all Wisconsin utilities combined, and less than 0.7% of total statewide CO_2 emissions. Although the potential increase in greenhouse gas emissions from this

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[8] Taken from the Wisconsin Department of Natural Resources' Wisconsin Climate Action Plan

[9] Taken from the U.S. EPA Office of Air and Radiation global warming website at www.epa.gov/globalwarming/climate/index.html.

[10] Nitrous oxide absorbs about 270 times more heat than carbon dioxide. Emissions of nitrous oxide are expected to be less than 10% of total NOx emissions, or about 33 tons per year. This is equal to CO_2 equivalent emissions of 8,600 tons per year.

project is certainly not insignificant, it is still relatively small compared with actual statewide emissions.

Table 3-9. Potential CO_2 emissions from the ESM Energy Center compared to the major Wisconsin utility and total Wisconsin CO_2 emissions.

	Emission Rate, lb/mmBtu	Annual Emissions, 1,000 tons per year
Energy Services of Manitowoc	218	1,060
Wisconsin Major Utilities[1]	210	54,170
Wisconsin Highway and Non-highway Transportation	n/a	45,300
Total Wisconsin Emissions	n/a	154,400

1. Data for the Wisconsin utilities and statewide emissions were taken from the Wisconsin Department of Natural Resources' publication Wisconsin Greenhouse Gas Emission Reduction Cost Study, PUB-AM-186 95.

3.1.6.1 Wisconsin's Climate Change Action Plan

The DNR, in cooperation with other agencies and organizations, has recently completed the Wisconsin Greenhouse Gas Emission Reduction Cost Study. The study states that Wisconsin's greenhouse gas emissions can be reduced by 21 million tons in 2010 by switching coal-fired power plants to natural gas. This change would double the state's consumption of natural gas. The study results estimate the cost for switching electric utility coal-fired power plants to natural gas would be about $460 million. However, this cost does not include the cost of expanding and extending natural gas pipelines and the associated environmental impacts, nor the potential increase in natural gas prices that this increase use of natural gas may cause.

The study suggests that energy efficiency savings may balance the cost of fuel switching. However, natural gas prices have increased dramatically since this study was completed. In order to realize the energy efficiency gains suggested in the study, a more rigorous and concerted effort on the part of the state regulatory agencies and the regulated community as a whole would be required. To that end the Wisconsin Climate Change Action Plan envisions specific, "… actions to implement energy efficiency measures". These actions call for the Wisconsin state government to lead by example; vigorously promote voluntary private sector-led initiatives to adopt energy efficiency measures; financial incentives for adopting energy efficiency measures; and a revision or update of existing building codes to support energy efficient improvements. Furthermore, the state plan calls for, "…actions to promote a shift to a higher proportion of cleaner energy sources". These actions are to include having the state government lead by example; vigorously promote voluntary private sector-led initiatives to move toward cleaner energy sources and technologies, financial incentives to increase renewable energy use, and participate actively in research and development projects designed to reduce emissions per unit of energy generated.

Currently, there are no regulatory requirements for individual projects such as the proposed ESM Energy Center to reduce or eliminate CO_2 emissions. At any rate, requirements to reduce emissions from this facility may be counterproductive if those requirements restrict this facility's utilization, since this project will be more efficient than the existing coal-fired generation equipment that it will displace. In that sense, limiting the deployment of new, modern power plants such as the ESM Energy Center may not be the best means to ultimately reducing greenhouse gas emissions.

3.1.7 Hazardous Air Pollutants

This power plant will be a source of trace element hazardous air pollutants (HAPs), hydrogen chloride and hydrogen fluoride emissions, trace organic HAPs, and ammonia. The potential HAP emissions from the ESM power plant are summarized in Table 3-10. No National Emission Standards for Hazardous Air Pollutants (NESHAPs) exist for fossil-fuel fired steam generators; petroleum coke, limestone, fly ash, and bed ash materials handling systems; nor any limestone dryer/mill. Because the total potential federal HAP emissions from this facility are less than 10 tons per year for any single HAP, and less than 25 tons for all HAPs combined, the ESM Energy Center will be a minor source of HAP emissions under 40 CFR Part 63. Since no other sources at this power plant are major sources of hazardous air pollutants, a Maximum Achievable Control Technology (MACT) determination is not required for this power plant.

Table 3-10. Hazardous air emissions from the ESM Energy Center.

Hazardous Air Pollutant	Tons per Year
Ammonia[1] (NH_3)	19.7
Hydrogen Chloride (HCl)	2.8
Hydrogen Fluoride (HF)	0.3
Trace Elements	0.9
Organic HAPs	0.8
TOTAL FEDERAL HAP EMISSIONS	**4.8**

[1] Ammonia is *not* a federal hazardous air pollutant.

3.1.7.1 Ammonia Emissions

From Table 3-10, approximately 75% of the potential HAP emissions is ammonia which results when unreacted ammonia "slips" through the air pollution control system used to control NO_x emissions. The emissions of ammonia are expected to be 4.5 pounds per hour. This emission rate is less than the threshold value of 6.28 pounds per hour under Wisconsin's air toxics regulations in NR

445.04, Table 1 for ammonia emissions from stacks greater than 25 feet in height. In addition, the potential annual emissions of 19.7 tons per year (39,400 pounds) is also less than the annual threshold for ammonia emissions under NR 445.04, Table 5 of 91,264 pounds. Since potential ammonia emissions are below these table values under NR 445,the maximum potential concentrations resulting from the ESM power plant will always be well below the ambient levels considered acceptable under NR 445.

In the atmosphere, ammonia will react with water and various compounds to form ammonium ion (NH_4^+). The ammonium ion can then be deposited on soils and result in increased nitrogen loading to soils and surface water. Increased nitrogen loadings can result in increased eutrophication of water bodies, especially warm-water inland lakes, wetlands, and streams. Like sulfate and nitrate deposition, the reaction of ammonia to form ammonium ion and then deposit onto soils or water bodies is generally considered a long range transport phenomena.

Background summer wet NH_4 deposition rates for northeastern Wisconsin have been estimated by the WDNR at 1.26 kg/hectare (0.23 lb/acre)[11]. If all emissions from this power plant were deposited uniformly in an area surrounding the plant within a radius of 200 miles, the ammonium ion deposition rate would be approximately 0.0002 lb/acre. This would represent less than 0.1% increase in the ammonium ion deposition rate. This increased loading is expected to have an insignificant impact on nitrogen loading in the region. As a result, the potential for impairment to soils and vegetation resulting from these pollutants is expected to be small.

3.1.7.2 Hydrogen Chloride and Hydrogen Fluoride Emissions

Hydrogen chloride (HCl) and hydrogen fluoride (HF) are acid gas emissions resulting from elemental chlorine and fluorine which occur in relatively low concentrations in the fuels and limestone. These emissions will be effectively controlled by the flue gas desulfurization system. The following reactions are the primary mechanisms for the removal of HCl and HF gases:

$$2HCl(g) + Ca(OH)_2\,(s) \rightarrow CaCl_2 \bullet 2H_2O$$

$$2HF(g) + Ca(OH)_2\,(s) \rightarrow CaF_2 \bullet 2H_2O$$

HCl and HF emissions are highly reactive, so the removal efficiency of these reactions is expected to be at least as high as the removal efficiency for sulfur dioxide. Based on an estimated 99% overall removal efficiency for HCl and HF emissions, the maximum hourly emission rates are expected to be 1.33 and 0.16 pounds per hour, respectively. These emission rates are less than the

[11] Taken from the Wisconsin Department of Natural Resources' Wisconsin Acid Deposition Monitoring and Evaluation Program, 1995 Report, Table 2.1-1b.

threshold values of 1.368 and 0.48 pounds per hour under NR 445.04, Table 1 for HCl and HF emissions from stacks greater than 25 feet in height. Since potential HCl and HF emissions are below these table values under NR 445,the maximum potential concentrations resulting from the ESM power plant will always be well below the ambient levels considered acceptable under NR 445. Since these emission concentrations were set to protect public health and welfare, the potential for impairment to soils and vegetation, and potential impacts to neighboring residents resulting from these pollutants is expected to be insignificant.

3.1.7.3 Trace Element HAP Emissions

Trace element HAP emissions include a number of trace metals and elements which naturally occur in the petroleum coke and limestone. During combustion, these trace elements are volatilized and may be emitted as inorganic oxides or elemental forms. Potential trace elemental emissions from petroleum coke combustion are summarized in Table 3-11. When combusting petroleum coke, trace element emissions from this source will always be below the NR 445 Tables 1 – 5 threshold values for stacks greater than 25 feet. Since these emission concentrations were also set to protect public health and welfare, the potential for impairment to soils and vegetation resulting from these pollutants is expected to be insignificant.

3.1.7.4 Trace Organic HAP Emissions

Trace organic HAP emissions may be emitted from the boiler as a result of incomplete combustion. Potential emissions for 30 organic HAP compounds are estimated in Table 3-12. These emission calculations are based on emission factors from U.S. EPA's AP-42, Compilation of Air Pollutant Emission Factors, 5th Edition, Section 1.0, Tables 1.1-12, except for benzene (C_6H_6) emissions. The benzene emission factor was taken from the U.S. EPA's FIRE database. Polycyclic organic matter (POM) emissions are based on the total of all PAH emissions as given in the U.S. EPA's AP-42, Compilation of Air Pollutant Emission Factors, section 1.0, Tables 1.1-13. From Table 3-12, the total potential emissions for all 30 organic HAPs is less than 1.0 ton per year. All trace organic HAP emissions in Table 3-12 are emitted below the Table 1 – 5 threshold values under NR 445, Wis. Adm. Code.

The only feasible method for the control of organic HAP emissions from boilers is good combustion controls. Since the ESM power plant is already applying the best available control for CO emissions which is good combustion practices, no other controls are considered feasible nor effective for the control of organic HAP emissions.

Table 3-11. Inorganic hazardous air pollutant (HAP) emissions for the ESM Energy Center.

AIR POLLUTANT	CAS No.	POTENTIAL TO EMIT			NR 445 TABLE VALUE			% of Table Value	OVER?
		lb/hr	lb/yr	tons/yr	Table	lb/hr	lb/yr		
Ammonia	7664-41-7	4.50000	39,420	19.710	1, 5	6.288	91,264	72%	NO
Antimony	7440-36-0	0.00004	0.32	0.000	1	0.17040		0%	NO
Arsenic	7440-38-2	0.00035	3.08	0.002	3A		25	12%	NO
Barium	7440-39-3	0.10413	912.20	0.456	1	0.17040		61%	NO
Beryllium	7440-41-7	0.00000	0.00	0.000	3B		25	0%	NO
Cadmium	7440-43-9	0.00010	0.91	0.000	3B		25	4%	NO
Chromium III Cmds	7440-47-3	0.02611	228.73	0.114	1	0.17040		15%	NO
Cobalt	7440-48-4	0.00029	2.54	0.001	4	0.01704		2%	NO
Copper	7440-50-8	0.00054	4.75	0.002	4	0.33600		0%	NO
Hydrogen Chloride	7647-01-0	0.31815	2,786.99	1.393	1	1.36800		23%	NO
Hydrogen Fluoride	7664-39-3	0.06933	607.29	0.304	1	0.48000		14%	NO
Lead	7439-92-1	0.00550	48.14	0.024	n/a				n/a
Manganese	7439-96-5	0.05735	502.36	0.251	1	0.98400		6%	NO
Mercury	7439-97-6	0.00208	18.24	0.009	1, 5	0.01704	274	53%	NO
Molybdenum	7439-98-7	0.00103	9.04	0.005	4	1.75200		0%	NO
Nickel	7440-02-0	0.01439	126.05	0.063	3B		250	50%	NO
Selenium	7782-49-2	0.00001	0.06	0.000	1	0.06720		0%	NO
Silver	7440-22-4	0.00005	0.46	0.000	n/a				n/a
Thallium		0.00000	0.00	-	4	0.03360		0%	NO
Uranium	7440-61-1	0.00022	1.94	0.001	4	0.06720		0%	NO
Zinc	7440-66-6	0.01040	91.10	0.046	n/a				n/a
TOTAL			**44,860**	**22.430**					

Table 3-12: Organic hazardous air pollutant emissions from the ESM Energy Center.

POLLUTANT	CAS No.	POTENTIAL TO EMIT			NR 445 TABLE VALUE			OVER?
		lb/hr	lb/yr	tons/yr	Table	lb/hr	lb/yr	
Acetaldehyde	75-07-0	0.0274	239.7	0.120	1	62.95		**NO**
Acetophenone	98-86-2	0.0007	6.3	0.003				
Acrolein	107-02-8	0.0139	121.9	0.061	1	0.09		**NO**
Benzene	71-43-2	0.0010	8.7	0.004	3A		300	**NO**
Benzyl chloride	100-44-7	0.0336	294.3	0.147	1	1.75		**NO**
Bromoform	75-25-2	0.0019	16.4	0.008				
Carbon disulfide	75-15-0	0.0062	54.7	0.027	1	10.49		**NO**
2-Chloroacetophenone	532-27-4	0.0003	2.9	0.001				
Chlorobenzene	108-90-7	0.0011	9.3	0.005	1	122.40		**NO**
Chloroform	67-66-3	0.0028	24.8	0.012	3B		250	**NO**
Cumene	98-82-8	0.0003	2.2	0.001	4	85.68		**NO**
2,4-Dinitrotoluene	25321-14-6	0.0000	0.1	0.000	4	0.50		**NO**
Dimethyl sulfate	77-78-1	0.0023	20.2	0.010	3B		25	**NO**
Ethyl benzene	100-41-4	0.0045	39.5	0.020	1, 5	152.14	912,636	**NO**
Formaldehyde	50-00-0	0.0115	100.9	0.050	3B		250	**NO**
Hexane	110-54-3	0.0032	28.2	0.014	1, 5	62.95	182,527	**NO**
Methyl ethyl ketone	78-93-3	0.0187	164.0	0.082				
Methyl hydrazine	60-34-4	0.0082	71.5	0.036	1	0.29		**NO**
Methyl methacrylate	80-62-6	0.0010	8.4	0.004	1	143.40		**NO**
Methylene chloride	75-09-2	0.0139	121.9	0.061	1	122.40		**NO**
Phenol	108-95-2	0.0008	6.7	0.003	1	6.62		**NO**
Propionaldehyde	123-38-6	0.0182	159.8	0.080				
Tetrachloroethylene	79-34-5	0.0021	18.1	0.009	1	2.45		**NO**
Toluene	108-88-3	0.0115	100.9	0.050	1, 5	131.16	365,054	**NO**
1,1,1-Trichloroethane	71-55-6	0.0010	8.4	0.004				
Styrene	100-42-5	0.0012	10.5	0.005	1, 5	75.19	912,636	**NO**
Xylenes	1330-20-7	0.0018	15.6	0.008	1	152.14		**NO**
Vinyl acetate	108-05-4	0.0004	3.2	0.002	4, 5	10.49	182,527	**NO**
Polycyclic Organic Matter		0.0010	8.7	0.004	3B		250	**NO**
2, 3, 7, 8 tetrachlorodibenzo-p-dioxin	1746-01-6	6.86×10^{-10}	0.000006	3.0×10^{-9}	3B		0.0001	**NO**
Polychlorinated dibenzofurans		0.000010	0.08	0.0000				
TOTAL, ORGANIC HAZARDOUS AIR POLLUTANTS		**0.2518**	**2,206**	**1.103**				

3.1.8 Mercury Emissions

Currently, 341 Wisconsin lakes and river stretches carry fish consumption advisories for mercury. DNR estimates that Wisconsin sources of mercury contribute as much as 50% of the mercury entering Wisconsin lakes. The rest comes from sources in other states and countries, and some comes from mercury-contaminated sediments already in the lake and river bottoms. Mercury is a naturally occurring element that is found in soil, wood, and petroleum. Because mercury is an element, human activities including the combustion of fossil fuels do not *create* mercury. Rather, these activities *transfer* mercury from the limestone or fossil fuels into the air. Mercury (Hg) emissions from the ESM Energy Center will occur as a result of trace amounts of this element in petroleum coke and limestone. Of all the inorganic HAPs on the federal HAPs list, mercury is generally present in limestone and petroleum coke at the lowest levels.

Potential mercury emissions from the ESM Energy Center are summarized in Table 3-11. From Table 3-11, total mercury emissions are estimated at about 18 pounds per year. ESM proposes to limit potential mercury emissions to no more than 0.021 pounds per hour. Based on this emission limitation, the ESM Energy Center will be a minor source of mercury emissions under the PSD Program in NR 405, Wis. Adm. Code.

3.1.8.1 Mercury Regulatory Initiatives

In May, 2000, the Wisconsin Department of Natural Resources received a petition to adopt rules requiring reductions in mercury emissions to the air. The petition was signed by a number of legislators, environmental organizations, conservation groups, and sports clubs. In its December Board meeting, the Natural Resources Board instructed the Department to begin drafting rules to reduce mercury emissions in Wisconsin. The Board instructed Department staff to prepare proposed rules for the March 2001 Board meeting that protect public health and the environment, but are cost effective, reasonable, and do not interfere with the utilities' ability to supply the state's energy needs.

In a separate regulatory initiative, EPA Administrator Carol Browner announced on December 14th that the EPA will require reductions of mercury emissions from coal-fired power plants. The agency plans to propose regulations by 2003 and issue final rules by 2004. Under the Clean Air Act, EPA was required to study toxic air pollution from power plants in order to determine if additional regulations are necessary to protect public health. EPA reported its study to Congress in February 1998. After completion of the study, the Clean Air Act required EPA to determine whether to proceed with the development of regulations. In the December 14th announcement, EPA affirmed its decision that mercury emissions from power plants should be regulated.

Although neither the Department nor the U.S. EPA have draft rules in place, previous Department and legislative initiatives in Wisconsin envisioned a flexible, cap-and-trade mercury control program similar to the federal Acid Rain Program and set reduction targets at 50 –70%. Affected sources would include point sources with actual mercury emissions of more than 10 pounds per year. The petition seeks a 90% reduction in mercury emissions from utility and government-owned boilers, municipal waste incinerators, and medical incinerators, among other potential sources by 2010.

3.1.8.2 Sources of Mercury In Wisconsin

Wisconsin sources emitted about 6,580 pounds of mercury to the atmosphere in 1995, with about half of those emissions coming from energy production. A detailed estimate of mercury sources is summarized in Table 3-13.

Table 3-13. Estimated mercury air emissions in Wisconsin in 1990 and 1995.

Energy Production		
Coal (total)	(2,361)	(2,508)
Electric Utility Coal	1,967	2,088
Industrial and Residential Coal	394	420
Petroleum Sector	580	509
Wood	13	10
Natural Gas	0.24	0.3
Refuse and Tire Derived Fuel	17	21
Gasoline & Diesel - Mobile	223	231
Subtotal	**3,188**	**3,268**
Resulting from the Purposeful Use of Mercury		
Latex Paint Volatilization	500	10
Municipal Solid Waste Combustion	1,041	176
On-site Household Waste Incineration	666	270
Medical Waste Combustion	363	601
Sewage Sludge Incineration	166	166
Fluorescent Lamp Breakage	107	107
Chlor-alkali Production	1,072	1,114
Volatilization during SW Collection & Processing	258	258
Miscellaneous	128	127
Subtotal	**4,774**	**3,168**
Emissions Incidental to Other Activities		
Pulp & Paper Manufacturing	4	4
Soil Roasting	12	12
Lime Production	92	128
Subtotal	**108**	**144**
GRAND TOTAL, ALL MERCURY SOURCES	**8,069**	**6,580**

Source: Bureau of Air Management, Wisconsin Department of Natural Resources.

3.1.8.3 Mercury Controls for Coal Combustion

Mercury emissions from coal combustion can be controlled through pre-combustion controls such as fuel cleaning, or through post combustion controls. Post combustion controls include particulate control systems such as electrostatic precipitators (ESPs) or fabric filter baghouses, flue gas desulfurization systems, and sorbent injection such as activated carbon. Table 3-13 summarizes the U.S. EPA's current knowledge on the control of mercury emissions from coal-fired utility boilers[12]. Note that there is no current information on activated carbon sorbent injection systems.

Table 3-13. Average mercury emission reductions for various control devices.

BOILER TYPE	CONTROL DEVICE	CONTROL EFFICIENCY	
		Bituminous Coal	Subbituminous Coal
Pulverized Coal	Cold Side ESP	46%	16%
Pulverized Coal	Hot Side ESP	12%	13%
Pulverized Coal	FF Baghouse	83%	72%
Pulverized Coal	Dry FGD Scrubber and FF Baghouse	98%	25%
Fluidized Bed Boiler	FF Baghouse	90%	No Test

During combustion, mercury in the coal, coke, and limestone is volatilized and may remain in a volatile or gaseous state throughout the boiler and pollution control systems. As long as the mercury remains in a volatile state, it cannot be collected by particulate control device. Typical flue gas temperatures for conventional coal-fired boilers in Wisconsin are approximately 300 ^{o}F for cold-side electrostatic precipitators (ESPs), and approximately 700 ^{o}F for hot-side ESPs. The use of FGD systems significantly reduces flue gas temperatures, providing the opportunity to condense and collect the mercury compounds. Flue gas temperatures exiting the proposed NID FGD system will be controlled to a constant output of about 142 ^{o}F. This reduced flue gas temperature in combination with the higher particulate control efficiencies for fabric filter baghouses is expected to enhance the condensation of mercury onto other entrained particulate matter, and considerably enhance mercury control.

The U.S. EPA estimates that the current air pollution control devices installed on utility coal-fired units capture an average of 43% of the mercury in the coals combusted in the United States (refer to the memorandum in Footnote

[12] Data taken from a U.S. EPA memorandum dated October 25, 2000 from Frank Princiotta to John Seitz. Fluidized bed boiler results are from EPA test results posted at the EPA web site http://www.epa.gov/ttn/uatw/combust/utiltox/utoxpg.html#TEC.

13, page 6). Based on the current state of knowledge, the average control in Wisconsin may be even less than this national average because of the high percentage of subbituminous coals combusted in Wisconsin and the consistently lower mercury control efficiencies for subbituminous coal. In addition, Wisconsin has at least one major coal-fired unit controlled with a hot-side ESP which is considered to have minimal mercury control. Conversely, coal combustion controlled by fabric filter baghouses and/or fabric filter baghouses in combination with a dry flue gas desulfurization system (the technology proposed for the ESM Energy Center) achieved 83% - 98% reduction in mercury. Therefore, the use of this technology could represent a 70% - 90+% reduction in the current mercury emission rates from coal combustion in Wisconsin. Furthermore, the EPA states that "Dry FGD systems are already equipped to control emissions of SO_2 and PM. The modification of these units by the use of appropriate sorbents for the capture of mercury and other air toxics is considered to be the easiest retrofit problem to solve." In other words, the controls proposed for the ESM Energy Center also have the greatest potential for even greater mercury control through sorbent injection.

3.1.8.4 Recent BACT Determination for Mercury Control

In 1999, the State of Florida issued Permit No. 0310045-003-AC (PSD-FL-265) for two CFB boilers with design heat input rates of 2,764 mmBtu/hr each at the JEA Northside Generating Station Jacksonville, Duval County, Florida. Under this permit, the power plant was subject to the application of the best available control technology for mercury controls. The State of Florida determined that the use of particulate matter control equipment in combination with SO_2 control equipment is the BACT for mercury control. Each boiler is limited to a mercury emission rate of 0.03 lb/hr, or 1.1×10^{-5} lb/mmBtu. Although the ESM Energy Center is not subject to the application of BACT for mercury, the proposed control equipment and synthetic minor emission rates are similar to those required as BACT for this Florida power plant.

3.1.8.5 Mercury Emissions from the ESM Energy Center

The level of mercury emissions from the ESM Energy Center will depend on the concentration of mercury in the fuel and limestone, and the control efficiency of the emission control systems. Table 3-14 summarizes potential mercury emissions based on various potential mercury control efficiencies. Note that even in the most conservative control scenario, The ESM Energy Center will have *potential* mercury emissions which are much less than 1% of the statewide actual mercury emissions. Therefore, this facility will not present a major new source of mercury emissions in Wisconsin. Note that at the high end of control efficiencies, this facility would have potential emissions below the likely threshold for regulation.

Table 3-14. Potential mercury emissions based on several control efficiencies.

CONTROL EFFICIENCY	POTENTIAL MERCURY EMISSIONS, lb/yr
70%	18
80%	12
85%	9
90%	6
95%	3
98%	1

3.1.9 Material Storage and Handling Fugitive Dust Emissions

The ESM-EC is proposed to include extensive control measures to control the emissions of fugitive dust from petroleum coke and limestone handling and storage. These dust control measures include the extensive use of buildings and enclosures around dust generating operations such as railcar unloading areas, covered conveyors, and enclosed conveyor transfer points with baghouse dust control systems. In addition, most of the power plant would be paved to reduce dust from vehicle traffic, and wind barrier walls are proposed to surround much of the C. Reiss Coal Company to prevent wind blown dust from the storage piles. These walls would be from 15 – 20 feet tall, and are expected to improve site aesthetics as well as reducing potential fugitive dust emissions.

3.1.10 Odors

This project will not result in any long-term or permanent perceptible odors. While the power plant will burn petroleum coke with limestone, the combustion process involves high temperature oxidation which results in complete combustion and destruction of odor producing products. Furthermore, material-handling processes will not cause or create any odors.

3.1.11 Air Quality Impacts – Construction Phase

In addition to long-term air quality impacts (as discussed above) short-term, temporary air quality impacts must be addressed. Air emissions from the project's construction phase will result primarily from the use of construction equipment needed to clear, excavate, contour, and grade land, construction of the structures, and associated fuel combustion emissions from trucks and other equipment. Air emission sources include site preparation activities, fugitive dust resulting from mobile equipment, wind-blown fine particulate matter, and combustion emissions from vehicles.

Total suspended particulates (TSP) constitute the major portion of the air emissions during the construction phase; a majority of which are fugitive dust emissions from grading activities and from excavation, hauling, loading, and dumping. Minor emissions of SO_2, NO_X, and CO will result from construction equipment exhaust. Chapter NR 415, Wis. Adm. Code, contains provisions for the control of fugitive dust. Applicable measures to control fugitive dust emissions will be used at the site. Potential dust resulting from construction activities and truck traffic will be controlled by following standard construction practices, which may include watering of exposed surfaces, reduced speed limits on the site, and limiting construction activities during high wind conditions.

Emissions generated during the construction phase will be generally limited to the site area and will not be dissimilar to the construction of numerous other businesses (e.g. office buildings, commercial property, etc.). Given the size of the project and the adherence to applicable dust control requirements, no significant impacts to local air quality are expected.

3.2 Surface Water Quality Impacts

As indicated in Chapter 1, there will be three wastewater discharges for the ESM-EC. The once through cooling system will have a separate outfall directly to Lake Michigan. Water discharge from the balance of plant sources including boiler blowdown, turbine drains, the water treatment plant (demineralizer) drains, and sanitary systems will be directed to the City of Manitowoc Wastewater Treatment Plant. Finally, this power plant will also have a storm water discharge which will be limited to the power plant itself.

3.2.1 Cooling Water Intake System

The cooling water intake system will withdraw 76,00 gallons per minute of cooling water from Lake Michigan. The withdrawal of water from Lake Michigan will require registration as required in s. 281.35, Wis. Stats. The cooling water intake system will consist of two (2) Johnson Screens® wedge wire screen cylinders. The Johnson Screen cylinders will be manufactured from a proprietary alloy which inhibits zebra mussel growth. In addition, the cylinders will be equipped with an air purge or "hydroburst" system to remove frazzle ice or other materials blocking the screens. The general specifications of the CWIS are summarized in Table 3-13.

Table 3-13. Cooling water intake system specifications for the ESM Energy Center.

Manufacturer	United States Filter Corporation
Construction	All-welded continuous Vee-Wire construction
Materials	Z-Alloy Material
Capacity	76,000 gallons per minute
Max. Through Slot Velocity	0.5 feet per second
Average Through Slot Velocity	0.45 feet per second
Screen Slot Size	0.1875" (3/16")
Pressure Drop	0.1 psi
Strength	Maximum differential pressure of 30 ft water

3.2.1.1 Design to Minimize Adverse Environmental Impacts

Under section 316(b) of the Clean Water Act, the Department is required to ensure that the cooling water intake systems are designed to minimize adverse environmental impacts. This evaluation includes several criteria, including:

1. The design and construction of the CWIS.
2. The intake flow relative to the receiving water volume.
3. The location of the CWIS.
4. The impact on threatened or endangered species.

3.2.1.2 Design and Construction of the CWIS

As stated above, the cooling water intake system (CWIS) will consist of two (2) Johnson Screens® wedge wire screen cylinders. The CWIS will be designed to achieve a maximum slot or approach velocity of no more than 0.5 feet per second at the maximum design flow of 76,000 gpm. This maximum approach velocity has been demonstrated to significantly reduce the potential to entrain fish and other aquatic life in the cooling water flow and is considered the Best Available Technology for cooling water intake systems.

Placement of the CWIS and pipe on or in the bed of Lake Michigan will require permits under s. 30.12, Wis. Statutes for the structures, and a contract under s. 30.20, Wis. Statutes for the removal of dredging materials.

3.2.1.3 Location of the Cooling Water Intake System

The CWIS will be located approximately 5,000 feet off the shore of Lake Michigan in a water depth of approximately 30 feet. Because of this area's limited water depth, this area may hold cool water and cold water fish. As indicated in Chapter 2, there is very little information available on habitat type at this location. Chart 8 from the NOAA Lake Survey indicates that no spawning areas were identified within 4 miles north or south of the proposed site.

3.2.1.4 Intake Flow Relative to the Receiving Water Volume

The intake flow relative to the receiving water body size is an important parameter in determining if the once through cooling system may present adverse environmental impacts. A large cooling water flow relative to the receiving water body may adversely impact the receiving water by causing relatively large increases in the water body temperature. The cooling water system is designed to use up to 76,000 gallons per minute, or about 110 million gallons per day (MGD). Lake Michigan has a volume of about 1,180 cubic miles, or about 1.3×10^{15} gallons. Therefore, the cooling water system has a daily volumetric flow of less than *one ten-millionth* of the total lake capacity. Similarly, the allowable mixing zone for the thermal discharge is a rectangle with dimensions of 2,500 ft x 1,250 ft, an area less than 0.0005% of Lake Michigan.

While the once through cooling system surface water use will have local impacts, the very small intake flow and mixing zone size relative to the volume and surface area of Lake Michigan is extremely small. This indicates that if local impacts are minimized, impacts to the overall lake are expected to be very small.

3.2.1.5 Impact on Threatened or Endangered Species

Based on an inquiry with the U.S. Fish and Wildlife Service and the Wisconsin Department of Natural Resources Bureau of Endangered Resources, no threatened or endangered species are expected to be present in the area of the proposed generating station. As a result, this power plant is not expected to have any adverse impacts to species of special concern.

3.2.1.6 Biocides and Zebra Mussel Control

Biologists believe that the Zebra mussel (*Dreissena polymorpha*) was introduced in North America around 1986 by the release of ship ballast water from a European port. The control of Zebra mussels in power plants has become a necessary routine plant maintenance activity in most power plants using cooling water from the Great Lakes. Problems with water intake systems occur when the zebra mussels attach to an internal pipe surface and to one another. When this happens, the mass of Zebra mussels can partially or totally occlude the pipe. If left untreated, Zebra mussel populations can severely reduce productivity and safety of a power plant.

3.2.1.6.1 Potential Zebra Mussel Treatment Methods

To protect the once-through cooling water system, several methods of Zebra mussel control can be used, including mechanical removal, heat treatment, and chemical treatment. In addition, Zebra mussel treatment can be employed to clean infected systems, or to prevent infestation.

The mechanical method of Zebra mussel control cannot prevent infestation. Unfortunately, once infestation has occurred, mechanical methods must be used to remove the adult mussels, such as hydroblasting or chiseling. Hydroblasting must be performed during a plant outage. In the meantime, the Zebra mussel infestation leads to a slow reduction in plant capacity and operating efficiency.

The thermal method of Zebra mussel control involves recirculating heated water through the system. Zebra mussels can be killed in as little as 15 – 30 minutes if water temperatures reach 40 °C (104 °F) or higher. The viability of heat treatment is highly dependent upon plant configuration. Unfortunately, because the once through cooling water intake system for the Energy Services of Manitowoc facility will be located 5000 feet offshore, recirculating warmed condenser water to the intake pipe is not feasible.

Chemical control of Zebra mussels may include both oxidizing and non-oxidizing biocides. Chlorination is the most commonly used form of oxidizing chemical control of Zebra mussels. A chlorine residual of 0.5 ppm can be maintained in a cooling water system in order to prevent infestation of Zebra mussels. However, the use of chlorine may have potential negative impacts to the receiving water.

Non-oxidizing biocides are also effective in controlling zebra mussels in cooling water systems. A common approach is the use of a quaternary amine as the acting biocide. The quaternary amine interacts strongly with the membrane proteins within the mussel to inhibit respiration. However, with the use of quaternary amines, detectable levels of the biocide in the outfall must be detoxified with the use of bentonite clay. Due to the concerns over the toxicity and relatively long half-lives of quaternary amine biocides, an alternate non-oxidizing molluscicide has been developed as the most recent generation of molluscicides. Calgon Corporation (now a subsidiary of NALCO) has developed a molluscicide called “EVAC”. EVAC is the amine salt of endothall. Endothall (CAS # 66330-88-9) is a common aquatic herbicide used for controlling algae and submersed aquatic weeds. This amine/endothall combination works to kill Zebra mussels by interfering with oxygen transfer across the gills. The amine has a high affinity for surfaces and does not exist in significant quantities in the plant discharge. In addition, the half life of EVAC is between 19-78 hours in comparison to the 28 day half life of most quaternary amines. Therefore, it does not persist in the environment for long periods. Because EVAC has a high affinity for surfaces, it is not found in the plant discharge at significant concentrations and does not require clay to deactivate.

3.2.1.6.2 Proposed Zebra Mussel Control

The ESM Energy Center proposes to use EVAC as the Zebra mussel control method. Treatment for Zebra mussel control using EVAC is normally conducted two, or in severe cases, three times per year. The first treatment occurs in the spring when water temperatures climb above 55 ^{o}F. A second treatment is typically performed in late fall, and, if infestations are severe, a third treatment in the mid-summer months may be necessary. EVAC is added to the circulating cooling water system at the inlet using the warm water or air line at concentrations of about 1.0 mg/L. Refer to Figure 10 for the treatment location. Because EVAC is readily adsorbed onto surfaces, including the Zebra mussel larvae, outfall concentrations are expected to be less than 0.06 mg/L.

Recently the Department evaluated EVAC for use as a biocide for Zebra mussel control and established a water quality-based limitation using the acute criterion calculation procedure in NR 105, Wis. Adm. Code. Utilizing the acute toxicity data available in the literature for Endothall for ten aquatic species, the Department calculated a Final Acute Value using the procedure in NR 105.05 of 0.071 mg/L. According to NR 106, the daily maximum limitation shall be equal to the Final Acute Value. Therefore, the Energy Services of Manitowoc has proposed the use of EVAC with a daily maximum discharge limitation of 0.071 mg/L.

3.2.2 Cooling Water Discharge System

The outfall for the cooling water system will be a shoreline discharge located approximately 300 feet south of the Manitowoc Wastewater Treatment Plant as shown in Figure 9. The discharge structure will include a channel with tight sheeting and riprap for erosion control. The discharge weir will have an estimated average depth of flow of 0.86 feet at an average discharge velocity of 4.3 feet per second. As stated above, the cooling system will have a maximum flow rate of 76,000 gallons per minute (156 ft^3/sec) at a maximum temperature rise of 13.4 ^{o}F. This is equivalent to a maximum heat rejection of about 470 mmBtu per hour.

Under NR 102.07(1)(a), Wis. Adm. Code, thermal discharges to Lake Michigan may not raise the temperature of the receiving water by more than 3 °F at the edge of the mixing zone. However, the temperature standards under NR 102, Wis. Adm. Code, are more stringent than federal requirements for steam electric generating stations. In a lawsuit filed on this issue, the Wisconsin Supreme Court ruled that the provisions of NR 102 do not apply to steam-electric generating stations, since Section 283.11(2), Wis. Statutes prohibits the Department from establishing requirements more stringent than federal standards unless the requirements are needed to meet water quality standards.

Pursuant to NR 102.07(1)(b), Wis. Adm. Code, shoreline discharges are allowed a rectangular mixing zone extending 1250 feet from the outfall along the shoreline and out into the lake, or a rectangle with dimensions of 2500 ft x 1250 ft. This is equal to a mixing zone area of 3,125,000 ft^2. The temperature of the receiving water at the edge of the mixing zone may be calculated using a method which simulates thermal changes in a cooling pond with a size equal to the allowable mixing zone area of 3,125,000 ft^2. The reference for this method is the Federal Water Pollution Control Administration, "Industrial Waste Guide on Thermal Pollution." Corvallis, Oregon, September, 1968. The primary assumptions used in this method are that the cooling water discharge disperses outward uniformly from a shoreline discharge and that the mixing zone acts as a cooling pond. This is a conservative assumption, since the much larger water body of Lake Michigan will have additional mixing due to currents and boundary diffusion. On page 102 of the above reference, an equation for the temperature through a pond is provided:

$$T_4 = (T_3 - T_b) \times (e^{-a}) + T_b$$

where:
T_4 = Temperature at the end of the mixing zone
T_3 = Temperature of the cooling water entering the mixing zone
T_b = Equilibrium (background) water temperature
e^{-a} = An empirical factor.

The exponent a is calculated as:

$$a = (K) \times (A)/\{(P) \times (C_p) \times (Q_3)\}$$

where:
K = Energy exchange coefficient (Btu/ft^2-day-°F)
K = 15.7 + (0.26+B) x (bW)
B = A coefficient which depends on the equilibrium temperature:

T_b	B	
50-60	0.405	(winter)
60-70	0.555	
70-80	0.667	
80-90	0.990	(summer)

B = Experimental evaporation coefficient = 15
W = Wind speed = 10 mi/hr
A = Area of the cooling pond (mixing zone) in square feet
P = Density of water = 62.4 lb/f^3

C_p = Specific heat of water = 1.0 Btu/lb-°F
Q_3 = Discharge volume in ft^3/day (note units)

Utilizing the methodology cited in "Industrial Waste Guide on Thermal Pollution." And the provisions contained in the States General Permit for Non-Contact Cooling Water or Condensate and Boiler Water (WPDES Permit No. 0044938-4), the Department of Natural Resources has proposed the following method for calculating water quality-based discharge limitations to protect fish and other aquatic life in the waters of Lake Michigan near Manitowoc.

Limitation = $[(WQV-T_b)/(e^{-a})] + T_b$

Where: Limitation = Water quality-based discharge limitation (in ^oF),
WQV = Water quality value (in degrees Fahrenheit),
T_b = Background temperature, expressed in degrees Fahrenheit; and
e^{-a} = An empirical factor; the exponent "a" is calculated as:
a = $[(A)(54.7 + B(150))] / [8,360,000)(Q_e)]$
Where: A = Area of mixing zone in square feet.
B = A coefficient which is a function of T_b as follows:

T_b	B	
50-60	0.405	(winter)
60-70	0.555	
70-80	0.667	
80-90	0.990	(summer)

Q_e = Discharge flow (in units of million gallons per day).

Site specific temperatures were provided by the Department of Natural Resources and were based on actual measurements made at the public water supply intake structure operated by the City of Manitowoc. In addition, Department staff evaluated the thermal tolerances of fish species present in Great Lakes waters and have proposed this project be evaluated utilizing the acute and chronic values in Table 3-15.

3.2.2.1 Thermal Discharge Impacts

The impacts of a power plant thermal discharge were studied for an 8 year period by the University of Michigan. The findings of this study were published in a report titled "Impact of the Donald C. Cook Nuclear Power Plant", University of Michigan, Great Lakes Research Division, Publication 22. The Donald C. Cook power plant is a 2,200 MW nuclear plant, and has a cooling water flow of 2400 million gallons per day at a temperature rise of 16 – 21 ^oF. In summary, this study found that while zooplankton and phytoplankton were impacted within the cooling water system itself, no measurable impacts were observed in the Lake. Since this plant is approximately 20 times larger than the proposed power plant, significant thermal impacts to the Lake are not expected.

3.2.2.2 Proposed Thermal Discharge Limitations

Based on the above thermal discharge calculations, the Energy Services of Manitowoc is proposing that the following water quality based thermal discharge limitations be incorporated into the WPDES permit for this power plant. The proposed thermal discharge limitations would be based on the average monthly temperature of the cooling water outfall.

Table 3-14. Proposed thermal discharge limitations for the ESM Energy Center.

MONTH	MAXIMUM ΔT, ^oF
January	**13.4**
February	**13.4**
March	**14.8**
April	**22.3**
May	**32.7**
June	**29.7**
July	**22.3**
August	**26.7**
September	**29.7**
October	**22.3**
November	**14.8**
December	**13.4**

3.2.2.3 Manitowoc Wastewater Treatment Plant Discharge

From Figure 9, the Manitowoc Wastewater Treatment Plant is located near the proposed outfall for the ESM Energy Center. As a result, it is possible that the cooling water outfall could impact the City of Manitowoc Wastewater Treatment Plant outfall. To determine if the proposed thermal discharge standards for the new power plant will ensure that the combined outfall from both facilities does not exceed the Department's thermal discharge guidelines, the combined discharge flow of both facilities can be considered in a similar analysis.

The Manitowoc Wastewater Treatment Plant outfall is approximately 375 feet north of the proposed ESM power plant outfall. The thermal mixing zones (with dimensions of 2500 ft x 1250 ft each) for the new power plant and the existing Manitowoc Wastewater Treatment Plant will overlap except for this distance of 375 feet. Therefore, the combined mixing zone for both facilities would have dimensions of 2875 ft x 1250 ft, or 3,593,750 square feet. Table 3-16 is a summary of the maximum allowable temperature increase by month for the ESM power plant based on the additional flow from the Manitowoc Wastewater Treatment Plant of 10.0 million gallons per day and the combined mixing zone. Note that the maximum allowable temperature increases in Table 3-16 are always less stringent than the proposed limits in Tables 3-14 and 3-15. This analysis confirms that the proposed thermal discharge limits for the ESM Energy Center will ensure that the cooling water discharge from this new facility in combination with the Manitowoc Wastewater Treatment Plant discharge will not exceed the department's guidelines and will not adversely impact Lake Michigan.

In addition to direct thermal effects, if toxic or hazardous substances were present in the City of Manitowoc's Wastewater Treatment Plant discharge, the elevated temperature of the water resulting from the new power plant could increase the toxicity and the potential for bio accumulation of these substances. However, reports submitted from the Wastewater Treatment Plant do not indicate the presence of any of the toxic pollutants or hazardous substances listed in Table 3-17. The City of Manitowoc is required to periodically monitor and report contaminants in the wastewater discharge, including the presence of the toxic pollutants and hazardous substances in Table 3-17. As a result, the thermal discharge from the ESM-EC is not expected to cause increased bio accumulation of toxic materials in the fish that may be attracted to the thermal discharge area.

3.2.2.4 Potential for Thermal Shock to Fish

Some electric generating stations have experienced increased fish mortality resulting from plant shutdowns that cause rapidly changing water temperatures and increased fish mortality. Because the warm water discharge is often a fish attractant, this affect can result in substantial fish mortality.

The potential for thermal shock is both a plant design issue and an operational issue. The ESM Power plant will be designed for a maximum normal temperature increase to the circulating cooling water of approximately 13.4 ^{o}F. This temperature is substantially less than the typical existing generating stations which have design temperature increases from 15 – 25 ^{o}F. This lower temperature increase will help ensure the power plant can meet the Department's guidance for thermal discharges, and can reduce thermal shock by reducing the maximum temperatures experienced by the attracted fish. In addition, the total plant discharge rate of 76,000 gallons per minute is relatively small compared to most central power stations on Lake Michigan. Although this design cannot eliminate the potential for thermal shock, it is expected to reduce this impact.

During operation, the power plant operators must be aware of the potential for thermal shock during plant startup and shutdown. Operating the circulating water pumps for a period before startup and after full shutdown to allow the water to slowly come to equilibrium is expected to reduce fish mortality. The potential for facility malfunctions which shut down the generator and the rapid loss of cooling water is also of concern. The plant will be designed to provide required plant service power even in an unexpected facility shutdown. This will allow for the rapid restart of the circulating water pumps which is also an important plant operational issue to ensure the condenser is not overheated. Well developed and implemented plant operating practices to ensure the circulating water pumps are restarted and operated as soon as possible after a unit trip is also expected to reduce fish mortality during these brief and infrequent periods.

Table 3-15. Maximum allowable cooling water temperature increases for the ESM Energy Center based on DNR's guidance on thermal discharge standards for a shoreline discharge to Lake Michigan.

MONTH	BACKGROUND TEMPERATURE	WATER QUALITY VALUE, °F		MIXING ZONE AREA	DISCHARGE FLOW			Coefficient	DISCHARGE LIMITATION		MAXIMUM ΔT
	°F	Acute	Chronic	ft^2	10^6 gal/day				Acute	Chronic	°F
Variable	T_b	WQC		A	Q_e	a	e^{-a}	B	°F		
January	34	64	43	3,125,000	109.3	0.3949	0.6738	0.405	78.5	47.4	**13.4**
February	33	64	42	3,125,000	109.3	0.3949	0.6738	0.405	79.0	46.4	**13.4**
March	35	64	45	3,125,000	109.3	0.3949	0.6738	0.405	78.0	49.8	**14.8**
April	39.5	66	54.5	3,125,000	109.3	0.3949	0.6738	0.405	78.8	61.8	**22.3**
May	45	67	n/a	3,125,000	109.3	0.3949	0.6738	0.405	77.7	n/a	**32.7**
June	48	68	n/a	3,125,000	109.3	0.3949	0.6738	0.405	77.7	n/a	**29.7**
July	54	69	n/a	3,125,000	109.3	0.3949	0.6738	0.405	76.3	n/a	**22.3**
August	51	69	n/a	3,125,000	109.3	0.3949	0.6738	0.405	77.7	n/a	**26.7**
September	49	69	n/a	3,125,000	109.3	0.3949	0.6738	0.405	78.7	n/a	**29.7**
October	51	68	66	3,125,000	109.3	0.3949	0.6738	0.405	76.2	73.3	**22.3**
November	42	67	52	3,125,000	109.3	0.3949	0.6738	0.405	79.1	56.8	**14.8**
December	35	65	44	3,125,000	109.3	0.3949	0.6738	0.405	79.5	48.4	**13.4**

Table 3-16. Maximum allowable cooling water temperature increases for the ESM Energy Center based on DNR's guidance when combined with the normal daily flow for the Manitowoc Wastewater Treatment Plant.

MONTH	BACKGROUND TEMPERATURE	WATER QUALITY VALUE, °F		MIXING ZONE AREA	DISCHARGE FLOW			Coefficient	DISCHARGE LIMITATION		MAXIMUM ΔT
	°F	Acute	Chronic	ft^2	10^6 gal/day				Acute	Chronic	°F
Variable	T_b	WQC		A	Q_e	a	e^{-a}	B	°F		
January	34	64	43	3,593,750	119.3	0.3949	0.6738	0.405	79.5	47.6	**13.6**
February	33	64	42	3,593,750	119.3	0.3949	0.6738	0.405	80.0	46.6	**13.6**
March	35	64	45	3,593,750	119.3	0.3949	0.6738	0.405	79.0	50.2	**15.2**
April	39.5	66	54.5	3,593,750	119.3	0.3949	0.6738	0.405	79.7	62.2	**22.7**
May	45	67	n/a	3,593,750	119.3	0.3949	0.6738	0.405	78.4	n/a	**33.4**
June	48	68	n/a	3,593,750	119.3	0.3949	0.6738	0.405	78.3	n/a	**30.3**
July	54	69	n/a	3,593,750	119.3	0.3949	0.6738	0.405	76.7	n/a	**22.7**
August	51	69	n/a	3,593,750	119.3	0.3949	0.6738	0.405	78.3	n/a	**27.3**
September	49	69	n/a	3,593,750	119.3	0.3949	0.6738	0.405	79.3	n/a	**30.3**
October	51	68	66	3,593,750	119.3	0.3949	0.6738	0.405	76.8	73.7	**22.7**
November	42	67	52	3,593,750	119.3	0.3949	0.6738	0.405	79.9	57.2	**15.2**
December	35	65	44	3,593,750	119.3	0.3949	0.6738	0.405	80.5	48.6	**13.6**

Table 3-17. Toxic and hazardous substances required to be identified in monitoring reports for WPDES permit discharges if believed present.

Asbestos	Dimethyl amine	Nitrotoluene
Acetaldehyde	Dintrobenzene	Parathion
Allyl alcohol	Diquat	Phenolsulfanate
Allyl chloride	Disulfoton	Phosgene
Amyl acetate	Diuron	Propargite
Aniline	Epichlorohydrin	Propylene oxide
Benzonitrile	Ethion	Pyrethrins
Benzyl chloride	Ethylene diamine	Quinoline
Butyl acetate	Ethylene dibromide	Resorcinol
Butylamine	Formaldehyde	Strontium
Captan	Furfural	Strychnine
Carbaryl	Guthion	Styrene
Carbofuran	Isoprene	2,4,5-T (2,4,5-Trichloro-phenoxy acetic acid)
Carbon disulfide	Isopropanolamine	
Chlorpyrifos	Dodecylbenzenesulfonate	TDE (Tetrachloro-diphenylethane)
Coumaphos	Kelthane	
Cresol	Kepone	2,4,5-TP [2-(2,4,5-Trichloro-phenoxy) propanoic acid]
Crotonaldehyde	Malathion	
Cyclohexane	Mercaptodimethur	Trichlorofan
2,4-D (2,4-Dichlorophenoxy acetic acid)	Methoxychlor	Triethanolamine dodecyl-benzenesulfonate
	Methyl mercaptan	
Diazinon	Methyl methacrylate	Triethylamine
Dicamba	Methyl parathion	Trimethylamine
Dichlobenil	Mevinphos	Uranium
Dichlone	Mexacarbate	Vanadium
2,2-Dichloropropionic acid	Monoethyl amine	Vinyl acetate
Dichlorvos	Monomethyl amine	Xylene
Diethyl amine	Naled	Xylenol
	Napthenic acid	Zirconium

3.2.2.5 Alternatives to a Once Through Cooling System

The only viable alternative to a once through cooling system for this power plant is a cooling tower. While cooling towers would reduce the required Lake Michigan water flow by 90% or more, cooling towers present other adverse environmental impacts, including:

1. Cooling tower wastewater or "blowdown" with elevated or concentrated total suspended solids and other contaminants.
2. Increased use of biocides.
3. Cooling tower air pollution emissions including particulate matter less than 10 microns (PM_{10}), chlorine, and formaldehyde (CH_3O).
4. Condensed plume, fogging, and the potential for icing in downtown Manitowoc.
5. Decrease in plant efficiency and output during summer months.

Since the data supplied by the applicant support a conclusion that a once through cooling system does not pose significant adverse environmental affects, the adverse environmental affects of cooling towers makes cooling towers a poor environmental choice for this power plant.

3.2.2.6 Construction of the Cooling Water System

The construction and installation of a cooling water intake system and a discharge weir will involve the installation of structures below the normal high water mark in Lake Michigan. The installation of these structures will require dredging and backfilling operations as described below. Placement of the cooling water intake system, intake pipe, and discharge weir on or in the bed of Lake Michigan will require permits under s. 30.12, Wis. Statutes for the structures, and a contract under s. 30.20, Wis. Statues for the removal of dredging materials.

3.2.2.6.1 Structures

The structures to be placed below the ordinary high water mark include the once through cooling system intake pipe and intake screens, and the once through cooling system discharge weir. The intake pipe will be constructed of concrete, and will be approximately 5,000 feet long commencing from the lakeshore. According to the requirements of s. 30.12(2), Wis. Statutes, the pipe and the cooling water intake structure must be installed so that they do not materially obstruct navigation. It is anticipated that the pipe will be placed below the surface of the lakebed along the entire route to ensure that the pipe does not obstruct navigation.

The intake pipe will be located near and will approximately parallel the submerged intake pipes installed and operated by the City of Manitowoc. The pipe will be installed in a manor similar to that for these existing pipes. Since the existing pipes do not obstruct navigation, there is no reason to conclude that this new pipe will present any new navigational issues. As noted above, the placement of the cooling water intake pipe on or in the bed of Lake Michigan will require a permit under s. 30.12, Wis. Statutes. This permit will include conditions which will ensure that the pipe is installed in a manner which minimizes navigational issues. After installation of the cooling water intake system is complete, the intake structure will be marked with a buoy.

The discharge weir will be placed at the lakeshore approximately 250 ft south of the City of Manitowoc Wastewater Treatment plant. The structure will involve excavation to final grades, installation of tight metal sheeting, and riprap for erosion control and protection.

3.2.2.6.2 Dredging Activities

To ensure that the pipe does not obstruct navigation, the pipe will be buried. A clamshell or dragline barge will be employed to install the intake pipe. The dragline will dig a trench by removing lakebed material, install the pipe, and cover the pipe back to the original lakebed profile with removed material or clean fill as required by the Chapter 30 permit. The total amount of material to be dredged is estimated at approximately 20,000 cubic yards, and the construction is expected to take about 3 months to complete.

Since the Manitowoc River is known to have sediments containing polychlorinated biphenols (PCBs), lakebed sediment sampling was conducted in October, 2000 to determine if the proposed pipeline location would be within the river delta, and to determine if the lakebed materials contain PCBs. Six sediment samples were taken from the lakebed surface by a scuba diver in locations shown in Figure 9. Sample numbers B-4, B-5, and B-6 were taken along the proposed pipeline route. Sample numbers B-1, B-2, and B-3 were taken north of the proposed pipeline route closer to the Manitowoc River harbor entrance. Location B-4A was not sampled in this study, since this location was covered with rocks.

After collection, the samples were split, with a portion of the sample analyzed for PCBs using U.S. EPA Method 8080, and a portion analyzed for grain size using ASTM Methods C-136 and C-117. Results of these analyses indicated that none of the samples contained PCBs above the detection limit of 37 μg/Kg (37 parts per billion) for total PCBs using U.S. EPA Method 8080. The grain size analyses are summarized below.

SAMPLE	CLASSIFICATION	PERCENT PASSING 200 SIEVE SIZE
B-1	Silty Sand	17.3%
B-2	Coarse Sand	0.7%
B-3	Coarse Sand	0.8%
B-4	Highly Compacted Silty Clay	76.6%
B-5	Highly Compacted Silty Clay	80.0%
B-6	Coarse Sand	1.2%

River delta deposits normally contain a high level of fine, silty material, and they may also contain high levels of organic matter. Sample B-1, the sample located nearest to the harbor entrance, was a silty sand deposit, indicating the presence of some fine sediment material within the coarse sand matrix. This sample may indicate the presence of some river sediments. Samples B-2, B-3, and B-6 were coarse sands with little or no indication of river sediments. Samples B-4 and B-5 did contain fine silt materials, but the lakebed in these areas was so compacted that the samples had to be chiseled from the lakebed. Highly compacted silty clay deposits such as these are not indicative of recent river sediment deposits. Based on this sampling, it appears unlikely that the proposed pipeline location will contain sediments which may be contaminated with PCBs or other river sediments.

The conclusion that the lakebed materials in the location of the proposed pipeline do not consist of river sediments is consistent with the fact that the normal or prevailing lakeshore currents in the area are northerly. That is, the lakeshore currents normally result in Manitowoc River sediments depositing primarily to the north of the river harbor. Furthermore, the first 2,000 feet of the lakebed is located to the south of the existing Manitowoc Harbor breakwater. This breakwater is expected to further reduce the likelihood that river sediments have been deposited in the area to be dredged. Finally, while PCB contamination is known to exist in the Manitowoc harbor area, the Manitowoc River area is not considered a major area of concern according to "The Great Lakes – An Environmental Atlas and Resource Book"[13].

Regardless of the lakebed materials encountered, the dredging activity will also require a Wisconsin Pollution Discharge Elimination (WPDES) permit for the carriage water discharge. Carriage water is the water that is trapped in the sediments and collected in the clamshell or dragline in the process of excavation. This permit would need to be obtained prior to construction. As long as no PCBs or other contaminants exist in the lakebed at the pipeline route, the carriage water may be discharged under the General WPDES Permit WI-0046558-2 new permit is -3 which covers carriage or interstitial water resulting from dredging activities. If any additional sampling performed for the Chapter 30 permit indicates the presence of PCBs or other contaminants in the sediments, the carriage water cannot be discharged under the general WPDES permit, unless the water can be treated and there is no net increase in the concentration of a contaminant. In this event, the applicant would be required to obtain a WPDES permit for discharges of the carriage water. An individual WPDES permit may be necessary if it is determined that the presence of contaminants needs more stringent regulation than is possible under the general permit.

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[13] "The Great Lakes – An Environmental Atlas and Resource Book, Third Edition 1995" is Jointly produced by the Government of Canada, Toronto, Ontario *and* the United States Environmental Protection Agency Great Lakes National Program Office Chicago, Illinois. It is available online at http://www.epa.gov/glnpo/atlas/intro.html.

3.2.3 Storm Water

3.2.3.1 Construction Phase

During the construction of this project, the entire construction area will be subject to the construction site storm water pollution control requirements under NR 216.42, Wis. Adm. Code. This chapter will require the development of erosion control plans, storm water management plans, and will also require monitoring and reporting. These plans and requirements are intended to reduce the impact of storm water erosion and runoff during construction. This site is relatively flat and has a buffer strip along the property lines to the Manitowoc Harbor area. As a result, large volumes of storm water are not expected. The use of the best management practices for construction site erosion control at this site such as silt fencing, curbing, grasses swales, and construction site work scheduling will minimize stormwater runoff impacts.

3.2.3.2 Operational Phase

This project is classified as a steam electric power generating station, and will be considered as a Tier 2 power plant under NR 216.21(2)(b)8., Wis. Adm. Code. As a result, this power plant will be required to obtain an Industrial Storm Water Discharge Permit before discharging from this project.

From Figure 3, the majority of the site owned and operated by the Energy Services of Manitowoc will either be paved, or will be covered by buildings or other equipment. As a result, potential contamination of storm water will be limited to runoff from these buildings, pavement, and equipment. Because the air pollution control systems and material storage on site are enclosed, storm water contamination from materials will be very limited.

3.2.3.2.1 Ground Water Impacts

The outdoor storage of petroleum coke and crushed limestone may be a source of storm water contaminants which could affect groundwater quality at the proposed power plant. The C. Reiss Coal Company will store up to approximately 100,000 tons of petroleum coke on the existing coal storage yard adjacent to the proposed site. The pile is expected to cover an area of approximately two acres and will be about 20 feet high. The amount of fuel in this pile represents an approximate 90 day supply for the plant.

Coal pile runoff can contain trace metals, polycyclic aromatic hydrocarbons (PAHs), and sulfates. If it is not properly managed, the runoff could contaminate groundwater. However, because steam electric generating facilities and coal storage facilities are regulated as Tier 2 facilities under the storm water pollution prevention regulations in NR 216.21(2)(b)8, the C. Reiss Coal Company and the ESM-EC will be required to prepare storm water pollution prevention plans to limit storm water runoff and impacts to ground and surface water. As a result of these regulations which are specifically designed to minimize adverse environmental impacts from storm water, the operation of this power plant is not expected to cause or contribute to adverse ground water impacts.

Crushed limestone, when dissolved, could act to buffer or raise the pH of the groundwater flowing beneath the site. However, it is not expected that a large amount of crushed limestone will be stored on site. The limestone will be used on a regular basis, and will normally be stored inside to keep it dry. Therefore, it is not expected that the crushed limestone piles will significantly affect groundwater quality beneath the proposed power plant.

3.2.3.2.2 Surface Water Impacts

Potential impacts to surface water from the outdoor storage of limestone and petroleum coke involve the same potential contaminants as for ground water impacts. However, the existing storage area is currently bermed to prevent significant surface water runoff. Additional site grading and berming will be performed in conjunction with this project in accordance with the Department's best management practices to control and to the extent possible prevent any surface water runoff to the Manitowoc River or lake Michigan.

3.3 Ash Byproducts and Solid Waste Disposal

As stated in Chapter 1, the primary byproduct from the flue gas desulfurization system and baghouse particulate control system is calcium sulfate or *gypsum* in combination with calcium oxide or lime. The byproduct will be collected and transported in its dry form. Gypsum is a common mineral which is used for making drywall and plaster of paris. Lime is also a common material used for making cement.

Based on the maximum rated capacity of the boiler and 8,760 hours per year of operation, the ESM power plant may produce about 72,000 tons per year of gypsum. Based on a typical gypsum density of 159 pounds per cubic foot (4,300 lb/yd^3), this maximum gypsum generation is equal to about 33,500 yd^3 per year.

3.3.1 Beneficial Reuse

Any beneficial reuse of the ash byproducts from the ESM-EC must comply with the Beneficial Reuse of Industrial Byproducts regulations under NR 538, Wis. Adm. Code. These regulations include requirements to characterize the byproduct prior to implementing any reuse options. NR 538 identifies many potential reuse options, including:

- Cement Production
- Structural or Ornamental Concrete Production
- Portland Cement Pavement Production

- Asphaltic Concrete Pavement
- Roofing Materials
- Plastics
- Wallboard
- Plaster

In addition, these materials may have potential for use under NR 538 as daily cover at municipal solid waste landfills, confined geotechnical fill, highway base coarse construction, utility trench backfill (flowable fill), and slabjacking material.

The beneficial reuse of the ash byproduct from the ESM power plant has many environmental benefits, including avoiding the use of valuable landfill space for the material, and the ability to displace the need to mine other raw materials. In addition, beneficial reuse almost always has the potential for a positive economic impact to the operating power plant. Reusing this material can add value to the product, resulting in a positive revenue source for the ESM-EC. Conversely, landfilling this material is a cost which reduces the profitability of the ESM-EC. As a result, the ESM power plant will have an economic incentive to find positive uses for this material. When this economic incentive is combined with the regulatory framework under NR 538 for ensuring the environmentally safe beneficial reuse of these materials, there is a strong reason to reduce the overall environmental impacts of this power plant.

As noted in Chapter 1.2, the power station in Kalundborg, Denmark produces about 170,000 tons of gypsum per year. A part of the gypsum is sold to a manufacturer that makes plasterboard products for the building industry, and a portion of this material is used for making fertilizer. This “symbiotic” relationship between the power plant and the local industries is a significant advantage in making the overall energy supply process more efficient. The ESM power plant has potential for the development of similar industries. While drywall or wallboard manufacturing is an obvious possible reuse option for this byproduct, other options also exist, including the production of lightweight, nonstructural concrete, flowable fill, manufacturing of lightweight aggregate material, and the production of fertilizers and other soil amendments.

3.3.2 Disposal in Local Landfills

If beneficial reuse options are not found , some of this material may require disposal in a local landfill. In that case, it would have to comply with all applicable state and local license requirements for the landfill receiving the materials. In addition, if the existing license for the landfill does not permit this type of waste to be accepted, the receiving landfill would be required to amend its operating plan and license.

As noted in Chapter 2, the Ridgeview Recycling and Disposal facility is an approved landfill operating under Wisconsin License Number 03041. In 1999, the landfill received 31,042 tons of ashes and sludges from electric and process steam generating facilities, and also received 150,319 tons of high volume wastes used as daily cover. At least some portion of the high volume wastes includes ash and byproducts from coal or petroleum coke combustion.

Disposal of this waste in a landfill is most likely to occur during periods when production or use of this material at other facilities is temporarily interrupted. Although the amount that could be landfilled is difficult to predict, it is not likely to exceed 10 – 25% of the total volume generated, or approximately 7,000 – 18,000 tons per year. ESM-EC has an economic incentive to avoid the necessity of disposing this waste in a landfill. If all of this ash were disposed at the Ridgeview facility, the landfill would see an increase in ash disposal of 20 – 50%, not considering the high volume of material used as daily cover. However, this disposal rate represents an increase of only 0.9 – 2.2% of the total tonnage of materials disposed in 1999 at the Ridgeview facility. Furthermore, because of the very high density of this material relative to many other solid wastes, the volume of ash disposal would be expected to be approximately 3,500 – 9,000 cubic yards per year. This volume use is expected to be about 0.4 – 1.1% of the remaining annual landfill volume.

3.4 Impacts to Vegetation, Wildlife, and Natural Resources

3.4.1 Wetland Impacts

There are no wetlands identified that are adjacent to or directly impacted by this project.

3.4.2 Impacts to Threatened and Endangered Species

Based on inquiries with the U.S. Department of the Interior, Fish and Wildlife Service Green Bay ES Field Office and the Wisconsin Department of Natural Resources Bureau of Endangered Resources, both agencies concluded that no Endangered, Threatened, or Species of Special Concern are expected to be impacted by this project. As a result, no direct impacts to these special resources are expected from this project.

As noted in Chapter 2, a pair of peregrine falcons, a state endangered species, have been successfully nesting on a platform on the Busch Agricultural Products Building No. 47 for two or three years (James Crawford, WDNR, Personal communication). Peregrines have been nesting successfully on power plant boiler house roofs and stacks for many years without any documented adverse impacts. Blood tests on adults and chicks at those sites have shown levels of lead or mercury, or other toxic substances that are found in the stack gasses, are not significantly different from those in birds nesting at non-power plant sites (Thiel, 1999).

To further evaluate potential impacts to these falcons, the ambient air impacts at the top of the Busch Agricultural Building No. 47 were determined using the U.S. EPA's accepted dispersion model. The results of this analysis indicate that the air quality on the rooftop of the Busch Agricultural Building is always in compliance with the national ambient air quality standards for all criteria air pollutants even after the construction and operation of the ESM Energy Center. Therefore, impacts to these falcons is expected to be small. It is also possible that the falcons may attempt to nest on the ESM boilerhouse or on the stack rather than on the Busch Agricultural building. If the birds are observed making this change, the project sponsor has indicated willingness to install the appropriate nesting structures to accommodate the peregrine falcons.

3.4.3 Impacts to Local Limestone Quarries

The limestone used in the ESM-EC may come from local quarries in Manitowoc County or nearby counties in east or northeast Wisconsin. These existing quarries are primarily "cut rock" quarries, producing higher quality rock for building construction and landscaping purposes. The limestone that would be used at the ESM-EC is the lower grade rubble or *overburden* that is currently removed and stockpiled to expose the higher quality rock underneath. This overburden could be used at the ESM-EC, and provide a potential supplemental revenue for the quarry operator.

The use of this overburden would result in an increase in production or removal of limestone from these quarries. In some cases, this increase could double the overall production from an individual quarry. Based on the maximum potential limestone utilization of 72,000 tons per year, the increased limestone removal would be about 36,000 cubic yards per year from these quarries. This volume of limestone is equal to a cube 100 feet high by 100 feet long by 100 feet wide. In a quarry with a working face of usable limestone 20 feet high and 500 feet wide, this is equal to using about 100 feet per year of quarry space. Because of the large quantity of limestone in the area, this increased utilization is not expected to have a significant impact to local limestone availability.

3.5 Community and Land Use Impacts

3.5.1 Brownfield Site Development

Over the last several years, much attention has been focused on "*brownfields*", which are defined as "abandoned, idle or underused industrial or commercial facilities or sites, the expansion or redevelopment of which is adversely affected by actual or perceived environmental contamination" (see, for example, s. 560.13, Wis. Stats.). At both the federal and state level, liability protections have been created and grant programs developed to remove the disincentives and create incentives to redevelop these properties. Wisconsin state agencies have been directed by the Legislature to give these projects high priority (see, for example, s. 292.255, Wis. Stats.)

The proposed site of the Energy Services of Manitowoc Energy Center was the subject of a July 1999 Phase 1 Environmental Site Assessment, commissioned by the Manitowoc Public Utilities. While this Phase 1 Environmental Site Assessment did not identify any known environmental contamination, it did identify several "environmental conditions", such as the historic use of the property as a rail yard, which can act as a deterrent to acquisition and redevelopment. The property is underutilized at this point, since it exists as a vacant industrial property in an area zoned and available for high level industrial use. Utilization of this site for the ESM-EC will serve the state and federal public policy goals of redeveloping existing underutilized industrial properties and putting them back into active economic production.

3.5.2 Land Use and Zoning Impacts

3.5.2.1 Impacts to Local Recreational Areas

During the construction phase of this project, the majority of activities associated with the construction of the proposed power plant will be confined to the proposed site. However, local semi-truck and rail traffic will increase during the construction phase. The nearest local recreational area is the Red Arrow Park located approximately 1 mile to the south of the proposed power plant. This park is not located on the major truck routes so that this increase in traffic is not expected to have a major impact on this park.

3.5.2.2 Farmland Impacts

The proposed site and the adjoining properties are zoned industrial. Therefore no direct impacts to farmland are expected from this project.

3.5.2.3 Impacts to Local Roads

3.5.2.3.1 Passenger Car Traffic

The Energy Services of Manitowoc power plant is expected to employ from 20 to 25 full time, skilled employees. During any shift, the maximum number of employees is expected to be fifteen. Based on an average passenger occupancy of 1.4 persons, these employees would add 11 cars or light trucks, or 22 round trips per day. If all of this passenger car traffic occurred on 7th and 8th Streets, traffic volume would increase less than 3% on 7th Street and less than 1% on 8th Street.

3.5.2.3.2 Truck Traffic

The Energy Services of Manitowoc power plant may receive processed or raw limestone by truck or rail, and it may ship ash by truck or rail. The total maximum annual limestone and ash usage and generation rates are 230,000 tons and 72,000 tons, respectively. This maximum rate is based on 24 hours per day and 365 days per year of operation. If all limestone and ash were shipped by truck in 25 ton semi-trailer trucks, the total annual truck loads would be 12,100, or 24,200 trips per year. This traffic volume is equal to 33 trucks per day, or 66 trips per day. If all of this truck traffic occurred on 8th Street, the major truck route, traffic volume would increase by 2.6%.

It is important to understand that this is a worst-case analysis, and assumes that the plant operates at 100% capacity for the entire year, and that all limestone and ash are received and shipped by trucks. In reality, the plant cannot operate at a 100% capacity factor, and at least some limestone and ash will be shipped by rail.

3.5.2.3.3 Total Impact to Local Road Traffic

Based on the above, worst-case analysis, the total traffic volume in the vicinity of the proposed power plant would increase by from 1 - 4% depending on the method that limestone and ash are received at and shipped from the power plant. This analysis demonstrates that traffic volumes will not be adversely affected by the proposed power plant.

3.5.2.4 Impacts to Local Railroads

The Energy Services of Manitowoc power plant may receive petroleum coke and processed or raw limestone by rail, and it may ship ash by rail. The total maximum annual petroleum coke usage is 450,000 tons; the total maximum annual limestone and ash usage and generation rates are 230,000 tons and 72,000 tons, respectively. This maximum rate is based on 24 hours per day and 365 days per year of operation. If all petroleum coke, limestone and ash were shipped by railcar in 100 ton cars, the total annual railcars required would be 7,500, or 15,000 trips per year. This traffic volume is equal to 21 railcars per day, or 42 trips per day. Based on the rail traffic data from Wisconsin Central, this rail volume would represent a 30 – 35% increase in rail traffic on the Wisconsin Central spur.

This increase in railcar volume is significant compared to the actual railcar volume. However, this increase in railcar traffic would be equal to about 1 to 2 additional trains per day. The total train traffic is currently 3 to 8 per day, or up to one per hour during the normal work day. The addition of 1 – 2 trains per day would increase the train traffic frequency from 1 every hour to 1 every 48 minutes. This increase would not normally be perceived. Therefore, this increased volume is expected to have a small affect on local train activity.

3.5.2.5 Changes to Private Property Values

Due to the industrial nature of the surrounding area, major changes in private property values due to the construction and operation of the proposed power plant are not expected. It is important to note that the development of this project is being made in close cooperation with the City of Manitowoc. The City of Manitowoc is developing a master plan for the development and renovation of the City Center and downtown harbor area. This project is an integral part of this master plan, and is generally considered as a valuable improvement to the existing vacant industrial area. As a result, this project is expected to generally enhance the immediate area and, as a result, this project may have a positive impact on local aesthetics and property values. In addition, the increased availability of process and space heating steam is a benefit to the downtown or City Center.

3.5.2.6 Secondary Development Impacts

The largest potential for secondary development around the ESM-EC includes industries that are steam "hosts", as well as industries which may utilize gypsum for manufacturing building materials or lightweight concrete. Since the area surrounding the proposed power plant is already highly developed with very little room for industrial growth, no secondary development impacts are expected in the immediate vicinity. However, to complete the industrial symbiosis described in section 1.2, the development of a building material wallboard manufacturing power plant may be beneficial both to the local economy, and to the environmental impact of the entire area.

3.5.3 Employment

The growth projection analysis only addresses permanent economic growth attributable to the power plant. Short-term or temporary impacts, such as construction, are not considered permanent growth and are not addressed as an additional impact. This project is expected to require 20 - 25 full time employees at the power plant. The City of Manitowoc and Manitowoc County have 1998 estimated labor forces of 16,300 and 42,900, respectively[14]. This project staffing level is much less than 1.0% of the City of Manitowoc labor force, and is much less than 0.1% of the Manitowoc County labor force. As a result, this project will not have a significant impact on direct employment in the area, and is not expected to impact residential housing requirements or new growth in the area.

[14] Source: Job Service, 1996 data. Data for 1998 is a projection.

3.6 Impacts to Local Municipal Services

3.6.1 Economic Base

Construction and operation of the proposed ESM-EC will add considerable economic benefit to the City of Manitowoc and the surrounding area. These benefits include:

1. Additional state and local taxes of 2% of gross sales, or an estimated annual revenue of approximately $580,000.
2. Construction employment to build the power plant is expected to average 35 craft personnel over a 20-month period with a total labor budget of $8 million.
3. Increased full-time employment including approximately 30 site staff positions, with an annual labor budget of approximately $2,100,000 along with approximately 13 support staff for transport, handling, and storage of fuels, limestone, and ash.
4. Increased full-time employment for C. Reiss Coal Company at the coal storage site of two positions with an annual labor budget of approximately $100,000.

3.6.2 Solid Waste Disposal

A small amount of solid waste will be generated during the construction phase of the project. Waste will be generated as a result of construction activities during site preparation and other activities such as removal of packing and shipping materials. The amount of waste produced during this phase of the project is expected to be small and will not significantly impact local solid waste disposal services.

During the operation phase of the project, ash byproducts will be managed for beneficial reuse or disposal as discussed in Section 3.6. Consequently, there will be no impact to municipal services with regards to this material. While the City will not handle any process related waste, normal and ordinary “trash” will be picked-up and disposed of by City crews. There will be approximately 20 – 30 full-time staff which will generate this waste stream. The volume of waste generated by the staff is expected to be very small in comparison to the current City generation rates so that no significant solid waste impacts are anticipated.

3.6.3 Fire Protection

The City of Manitowoc Fire Department provides fire protection for all structures within the City. Fire protection will be provided and coordinated by municipal facilities currently in place in the City of Manitowoc. The fire department is staffed 24-hrs/day, 7days/week, 52 weeks/year by 49 full-time professional fire protection personnel. Twenty of these are certified HAZMAT team members. The HAZMAT team members maintain their certifications on an on-going basis. This power plant will be well protected and is not expected to significantly impact the level of services provided in the area.

3.6.4 Emergency Medical Services

The City of Manitowoc Fire Department will also provide emergency medical services to the project site as needed. Of the 49 full-time professional fire protection personnel, 48 make-up the emergency medical services team. This team consists of professional first responders, emergency medical technicians (EMTs) and paramedics. Of the 48 members of the emergency medical services team 23 are paramedics. This power plant will be well protected and because of the relatively low number of employees on staff at the ESM power plant, no significant impact to the level of services in the area are expected from this project.

3.6.5 Police Protection

The City of Manitowoc Police Department will continue to provide service to the project site. The Police Department is currently staffed by 66 full-time professional warrant officers that are supported by a civilian staff of 11. Because the proposed site is adjacent to the important municipal facilities including the Manitowoc Public Utility generating station and the City of Manitowoc's Water and Wastewater Treatment plants, providing additional protection to this small power plant is not expected to have any significant impact on the level of services in the area.

3.6.6 Water Supply

The City will be installing complete sewer and water services as part of the proposed project. The normal peak and average water treatment rates are 14 and 10 million gallons/day, respectively. The City's current water treatment capacity is approximately 22 million gallons/day. Average balance of plant water usage rates for the ESM-EC (about 59,000 gallons per day) would be supplied by the City of Manitowoc system. This water usage rate represents an increase in water supply demand of 0.6%. Consequently, the impact to local water treatment capabilities is inconsequential and well within current treatment plant capabilities.

3.6.7 Wastewater Treatment

The power plant will generate both once through cooling water and process wastewater. Once through cooling water will be discharged directly to Lake Michigan in compliance with all applicable wastewater discharge regulations. Therefore, it will not have any direct impact on municipal services (see Section 3.2.2). However, process wastewater will be discharged directly to the City of Manitowoc's wastewater treatment plant. The ESM-EC's peak and average project wastewater usage rates will be approximately 2,000 and 1,400 gallons/day, respectively. The normal peak and average wastewater treatment rates for the City of Manitowoc wastewater treatment plant are 12.5 and 10 million gallons/day, respectively, with a maximum wastewater treatment capacity of approximately 15.5 million gallons/day. Therefore, these wastewater discharge rates from the proposed ESM-EC represent an increase in wastewater treatment needs of 0.02% and 0.01%, respectively. As a result, the impact to local wastewater treatment services is inconsequential and well within current treatment plant capabilities.

3.7 Archaeological or Historic Site Impacts

An archaeological survey was performed by Mr. Robert P. Fay, an archaeologist with Old Northwest Research. Mr. Fay concluded that the proposed site warrants no further archival, historic, or archeological research. As a result, this project is not expected to have any impact on any significant archaeological or historic sites. In a letter from Mr. Sherman J. Banker, a Compliance Archeologist with the State Historical Society of Wisconsin to Mr. Gregory J. Eirschele dated September 14, 2000, Mr. Banker concluded that the survey procedures were sufficiently thorough to justify the conclusion that there are no archeological resources eligible for inclusion on the national Register of Historic Places.

3.8 Impacts to Site Aesthetics

The tallest structures on the site will include the boilerhouse at a height of 150 ft, and the stack at a height of approximately 300 ft. (The tallest building on the Busch Agricultural Products site located immediately next door is 200 ft.) The total area to be developed is less than 5 acres in downtown Manitowoc.

It is important to note that the development of this project is being made in close cooperation with the City of Manitowoc. The City of Manitowoc is developing a master plan for the development and renovation of the City Center and downtown harbor area. This project is an integral part of this master plan, and is generally considered as a valuable improvement to the existing vacant industrial area. As a result, this project is expected to generally enhance the immediate area and, as a result, this project may have a positive impact on local aesthetics and property values. In addition, the power plant is being designed to include wind barrier walls around much of the fuel and limestone storage piles. These walls would be from 15 – 20 feet tall, and are expected to improve site aesthetics as well as reducing potential fugitive dust emissions.

3.9 Noise Impacts

3.9.1 Operation Noise

The Sound Level Evaluation report in Appendix A includes a detailed 3-dimensional acoustical modeling analysis of the proposed generating station. Potential noise sources included in this analysis include:

- Powerhouse Building (containing the steam turbine and electric generator)
- Boilerhouse
- Boiler Primary and Secondary Fans
- Baghouse
- Induced Draft Fan
- Water Treatment Building
- Railcar Unloading Building
- Solid Fuel Conveyors
- Limestone Unloading
- Limestone Preparation
- Fuel Crushing
- Building Ventilation
- Main Electric Transformer
- Front End Loader

In this analysis, noise produced from the plant operation was estimated for daytime operation (periods from 7:00 am to 7:00 pm), and nighttime operation (7:00 pm to 7:00 am). These time intervals were selected to represent the plant only noise (i.e., nighttime operation), and plant noise plus fuel and limestone handling and front end loader operation (i.e., daytime operation).

The results of this analysis are included in Table 3-16. Table 3-16 reports both the predicted noise level impacts from the ESM power plant and the total location sound level using the *Day-Night Level*, or L_{DN}. The L_{DN} is a single number which represents a 24-hour sound level within a community. The L_{DN} is calculated by adding a 10 decibel "margin" to sounds that occur between 10:00 pm and 7:00 am to account for increased sensitivity in residential areas when individuals are resting or sleeping.

3.9.1.1 Noise Ordinances and HUD Guidelines

As noted in Chapter 2, the proposed site is zoned I-2 Heavy Industrial. The City of Manitowoc does not currently have any noise ordinances for areas zoned I-2 Heavy Industrial.

The Department of Housing and Urban Development (HUD) has established guidelines for noise levels in residential areas. HUD considers sites where the L_{DN} sound levels are below 65 dBA to be acceptable for residential use. From Table 3-18, all of the residential sites are predicted to be below this guideline during the operation of this plant.

Table 3-18. Predicted sound level impacts for the ESM Energy Center.

LOCATION	DESCRIPTION	ESM PLANT L_{DN}, dBA	TOTAL L_{DN}, dBA
1	The Inn on Maritime Bay	51 - 60	60
2	Manitowoc Public Library	49 - 58	58
3	Intersection of 10^{th} and Marshall Street	45 - 46	52
4	Intersection of Marshall and Lake Street	57-58	63
5	Intersection of 8^{th} and Madison Street	43 - 49	51
6	Manitowoc Sewerage Treatment Plant	62 - 64	68

3.9.1.2 Sound Levels Along Lake Street

Receivers along Lake Street (Location 4) may experience the greatest change to existing sound levels after the power plant becomes operational. During nighttime hours, the most significant contributor of plant noise at these residences is from the induced-draft (ID) fan system. ID-fans are normally a broadband noise source, (i.e., sound energy evenly spread over the entire frequency range.) This noise is usually less annoying, and may be broadly classified as “white noise”. Depending on the mechanical parameters of the fan and the design of duct work leading from the fan to the stack, ID fan systems can sometimes produce tonal noise, (i.e., sound energy concentrated in a narrow frequency range) which has the potential to be more bothersome. To minimize noise levels, the induced draft fan must be designed properly. If not, silencers may be necessary to mitigate noise impacts.

During daytime hours, noise from rail-car shaker operations, radiated from the walls of the solid-fuel unloading building, is also an important contributor of plant noise at nearby homes. The Sound Level Evaluation Report notes that the design of the plant to incorporate extensive dust control measures such as the fuel and limestone unloading buildings will also serve to reduce noise levels. The construction of the solid-fuel unloading building was modeled based on a simple, 24-gage exterior steel wall with an interior liner of fiberglass. If necessary, noise emissions from the building can be reduced by improving the structure by increasing the mass of the wall, (i.e., heavier gage steel sheet) or by using a double-wall construction.

3.9.2 Construction Noise

During construction, noise levels may be impacted by heavy equipment such as graders, dump trucks, and steel erection. The report considered five major phases of construction and the potential impacts to the nearest residence. The report predicted that temporary construction site noise may be as high as 70 dBA at Site No. 4. However, this level is expected to be primarily daytime noise during the grading and excavating and steel erection phases and is, of course, a temporary source.

3.10 Electric Transmission Line Impacts

The electric transmission line will be a double circuit 138,000 volt line as described in Chapter 1. The total length of the transmission line will be approximately one-quarter mile, and will follow the existing rail corridor and right-of-way. Because of the short length of this transmission line and the fact that an existing right-of-way already exists, the impact from the installation of this line is expected to be minimal. Under PSC 4.80(2), Table 3, Wis. Adm. Code, the installation of electric transmission lines with a total length of less than 1 mile is a Type III action which does not require an environmental assessment or EIS.

Chapter 4. Alternatives to the Proposed Action

The proposed Energy Services of Manitowoc Energy Center involves the construction and operation of a solid fuel-fired electric generating station to serve the City of Manitowoc. The project is proposed by ESM in response to a need identified by the City of Manitowoc and Manitowoc Public Utilities (MPU) for additional energy to meet anticipated needs. The project will provide electricity and steam to the City of Manitowoc and adjacent users, and the opportunity for industrial synergies with local industrial and institutional facilities. The following alternatives to the project as proposed were considered by the applicant and its potential customers, and rejected as not desirable or viable.

4.1 No Action Alternative

One alternative to the proposed project is the “no action” alternative, i.e., not to build the project. This alternative was not considered to be desirable because it would result in significant missed opportunities to serve the needs of the community and to produce positive environmental benefits.

The project is proposed in response to the need identified by the City of Manitowoc and Manitowoc Public Utilities (MPU) for additional energy to meet anticipated future demands. As such, it is a component of the statewide response to assuring reliable energy supplies and is consistent with the recent legislative actions to accomplish that important goal. It will do so using state-of-the art pollution control systems that will achieve emission rates far below those of Wisconsin's existing coal-fired electric generating capacity. The power plant will augment and eventually replace existing generation, especially during non-peak periods when this power plant will produce power at a lower cost. It will replace existing units which have much higher emission rates for the pollutants of concern, thus ensuring continuing improvements in air quality. If the project is not built, it will not contribute to solving Wisconsin’s reliability problems and these opportunities for improvements in air quality will be missed.

As proposed, the ESM-EC will form the core of an industrial synergy – providing electricity to the City of Manitowoc and other municipal utilities, supplying steam to MPU to heat and cool the Lincoln High School and other municipal buildings, and supplying process steam to the Busch Agricultural Products facility located immediately adjacent to the proposed site. C. Reiss Coal Company will provide its existing facilities for fuel and limestone receiving to be used at the ESM power plant. The flue gas desulfurization system byproduct of gypsum, a potentially valuable byproduct for building material manufacturing and fertilizer production, will be available to potential industrial users and may create incentive for location of such a power plant in the immediate vicinity. If the project is not built, the opportunity to create the core of such an "Eco Industrial Park" will be missed.

The ESM-EC is proposed to be located on a vacant industrial site, immediately adjacent to the City of Manitowoc Wastewater Treatment Plant. As such, it presents an opportunity for redevelopment of an underutilized *brownfield* property. If it is not built, that opportunity will also be missed.

For these reasons, the "no action" alternative is not considered a desirable or viable option.

4.2 Alternative Sites

Because the need for this power plant was identified by the City of Manitowoc and Manitowoc Public Utilities, the process of site selection was necessarily limited to sites in Manitowoc which would serve the needs of those users. The site selection process was further limited by the need for the proposed power plant to be located near both the primary electric load center and the steam customers. The City of Manitowoc identified the proposed project site as the only one which meets those criteria and is located in an industrialized area of Manitowoc on vacant, underutilized industrial property. This is the best available site to allow the proposed plant to most efficiently deliver energy to its customers. In addition, the site has the following beneficial characteristics:

- Existing rail access
- Existing coal yard for petroleum coke storage
- Close access to electric transmission equipment
- Close proximity to Lake Michigan for cooling water.

These site attributes reduce this plant's impact by using existing infrastructure rather than constructing new facilities, rail corridors, and transmission lines. In addition, this site provides an excellent opportunity for brownfield redevelopment – making this site extremely well-suited for this project. As noted in Chapter 2.7, there are a number of other vacant industrial sites in the City of Manitowoc. However, none of these other sites has the unique combination of attributes which makes this site ideal for this project.

4.3 Alternative Power Supply Options

Alternate power supply options for this project may include gas turbine combined cycle generating units, a natural gas or fuel-oil fired boiler and steam turbine plant, or renewable energy generating systems such as wind energy. Each of these alternatives has potential advantages for providing energy to the City of Manitowoc, as well as significant disadvantages that have eliminated them from consideration for this project.

4.3.1 Gas Turbine Combined Cycle Generating Units

As indicated in Chapter 1, natural gas and distillate fuel oil-fired gas turbines have provided almost all of the new electric generating capacity in Wisconsin since 1995. As a matter of fact, natural gas and fuel oil-fired electric generating capacity have provided almost all new electric generating capacity since the late 1970s.

4.3.2 Natural Gas-Fired Combined Cycle Power Plant

A natural gas-fired combined cycle power plant was first considered for this power plant, but was rejected because the downtown Manitowoc area does not have sufficient natural gas pipeline capacity to support a 99 MW natural gas-fired combined cycle power plant. To support a 99 MW natural gas-fired combined cycle power plant, a new natural gas distribution pipeline would be required from the ANR pipeline to the downtown area. This new pipeline would be approximately 2.5 miles in length and would need to be constructed in the City of Manitowoc. In addition, there are significant concerns regarding the capacity of the existing ANR pipeline supplying the Manitowoc area and its ability to meet the natural gas requirements of a baseloaded 99 MW facility. Because of these serious natural gas supply and infrastructure concerns, a natural gas-fired power plant was eliminated from consideration.

4.3.2.1 Fuel Oil-Fired Combined Cycle Power Plant

It would be *technically* feasible, however, to construct a gas turbine combined cycle power plant firing distillate fuel oil. A distillate fuel oil-fired gas turbine combined cycle plant was not considered because the very high fuel cost for distillate oil makes the project uneconomical. In existing gas turbine generating stations, fuel oil use is confined almost completely to a backup fuel for use during natural gas supply curtailments.

Even though a distillate fuel oil-fired gas turbine combined cycle plant is not feasible economically, a comparison of potential criteria air emissions can be made. To compare air emissions, an approximate 99 MW combined cycle power plant could consist of two General Electric Frame 6 combustion turbines, a heat recovery steam generator, supplemental duct burners, and a steam turbine/electric generator set. To achieve the same steam and electric energy output, the power plant would need a heat input capacity of approximately 850 mmBtu/hr. Potential emissions from a combustion turbine operating for 8,760 hours per year are summarized in Table 4-1. NO_x emissions are estimated based on an emission rate of 8.0 ppmdv at 5% O_2, an emission level considered to be the best available control technology (BACT) for similar facilities.

Table 4-1. Potential criteria air emissions from a 99 MW distillate fuel oil-fired gas turbine / combined cycle electric generating station.

AIR POLLUTANT	EMISSION FACTOR	POTENTIAL TO EMIT	
	lb/MW-h	lb/hr	ton/yr
Carbon Monoxide (CO)	0.50	38.0	166.4
Nitrogen Oxides (NO_x)	0.31	23.6	103.2
Particulate Matter (PM)	0.40	30.4	133.2
Sulfur Dioxide (SO_2)	0.53	40.3	176.4
Volatile Organic Compounds (VOC)	0.26	19.6	85.7

From Table 4-1, the potential emissions of CO, NO_x, and SO_2 would be expected to be less from a distillate fuel oil-fired gas turbine combined cycle generating power plant then for the proposed solid fuel CFB boiler. However, potential emissions of particulate matter and VOCs would be expected to increase for such a power plant as compared to the proposed ESM-EC.

In addition to air emission considerations, it is important to note that a distillate fuel oil-fired gas turbine combined cycle plant would have similar cooling water, supply water, and electric transmission requirements as the proposed power plant. While this power plant would not require petroleum coke or limestone, the power plant would combust approximately 6000 gallons of oil per hour, or about 53,000,000 gallons per year. This oil consumption would require at least two 1.0 million gallon fuel oil tanks. This high level of oil storage near the harbor area and Lake Michigan would also be a disadvantage for this type of plant.

4.3.2.2 Natural Gas or Fuel Oil Use

If this power plant were constructed as a natural gas or distillate fuel oil fired combined cycle power plant, the power plant would consume about 5 trillion Btu of fuel energy per year. Based on the Department of Administration's Wisconsin residential energy natural gas use estimate of 120 trillion Btu in 1998, the City of Manitowoc uses approximately 0.6 trillion Btu of natural gas per year. In this case, a combined cycle natural gas-fired power plant would use approximately 10 times as much natural gas as the City of Manitowoc currently uses for residential heating.

4.3.3 Natural Gas or Fuel-Oil Fired Boiler

As noted in the previous section, natural gas is not a viable primary fuel because the existing natural gas pipelines cannot meet the demand requirements for this plant. Air emissions from a distillate fuel oil-fired boiler would be similar to the emissions from the fuel oil fired gas turbine discussed in the previous section. In addition, as with the combined cycle power plant, a fuel oil-fired boiler would have similar cooling water, supply water, and electric transmission requirements as the proposed power plant, and would also combust approximately 6000 gallons of oil per hour.

4.3.4 Use of Wood as a Fuel

According to the Wisconsin Energy Statistics – 1999, Wisconsin electric utilities used 334,000 tons of wood in 1998. Almost all of this wood was used at two generating stations operated by Northern States Power Company in western and northern Wisconsin. The ESM Energy Center CFB boiler has the capability to combust wood and wood waste as supplemental fuels. However, some fuel handling equipment changes would be necessary to utilize wood as a fuel. The use of wood as a supplemental fuel may have environmental benefits, including the potential for reduced SO_2 emissions, and the potential to reduce net CO_2 emissions since wood is generally considered a renewable resource. The potential ability for this facility to utilize wood and wood waste for energy production stands in contrast to natural gas or fuel oil-fired combined cycle facilities which cannot utilize any solid fuel.

In 1998, the Wood RP Group prepared a report for the Wisconsin Department of Administration's Wisconsin Energy Bureau entitled "Geographic Analysis of Wood Residues in Wisconsin". The report identified the Horicon and Oshkosh areas as potential sites for new wood-fired generating capacity. This report indicated that within a 50 mile radius of the Horicon and Oshkosh areas, the potential annual wood residue generation rates are 1.4 and 1.2 million tons per year, respectively. Both of these study areas encompass the Manitowoc area. While this study indicates the potential for a significant amount of wood residues available for fuel, this estimate is based on a significant urban wood waste generation rate, and it also assumes that all of the waste can be available and delivered to the facility economically.

In the above report, the urban wood residue generation rate was estimated at 0.55 tons per person per year. The report did not specify the amount of the total wood residue available which is urban wood waste. However, based on estimated populations of 1 million in each area, the amount of urban wood residue is approximately one-half of the total estimated annual wood residue available. Urban wood residue was estimated as about 20% tree trimmings and about 80% construction and demolition debris.

The use of construction and demolition debris would require a significant amount of source separation and preprocessing to produce a feasible fuel. While this is a feasible option for managing the current solid waste streams in these areas, it would require the cities and municipalities to change their source separation procedures, and would probably require longer haul distances to deliver it to the ESM facility. For wood residues to be a competitive economic choice for this facility, the wood residues need to have heating values of at least 6000 Btu per pound, and need to have delivered costs of no more than about $5 – 6 per ton. Because of these economic and infrastructure issues with supplying wood to this facility, the actual amount available for use will be much less. Never-the-less, even if only 5% of the above estimates are available, this facility could use approximately 50,000 tons per year of wood waste. At an average heating value of 6,000 Btu/lb, this wood use could result in an annual net electric generation of 57,000 MWh per year. Based on an average wind farm capacity factor of 23%, this wood use would supply the same amount of energy as a 28 MW wind farm.

4.3.5 Use of Coal as a Fuel

Because the plant will be designed for petroleum coke, coals which may be used as an alternative fuel must have properties similar to petroleum coke. This is because the boiler, fuel handling, storage, and feed equipment, and ash handling equipment are all designed based on the attributes of petroleum coke. There is a substantial difference in heating value, moisture content, and fixed carbon content between petroleum coke and subbituminous coals. While low Btu fuels such as subbituminous coals could be used in this boiler as a supplemental fuel, the use of low Btu subbituminous coals as a primary fuel would result in a significant electric generating capacity loss, or would require significant changes to the plant design and operation to accommodate these fuels which would compromise its performance when using petroleum coke.

Low sulfur western subbituminous coals from Wyoming and Montana have become the predominant coal used in electric generating stations in Wisconsin and much of the Midwest. The Wisconsin Department of Administration's Wisconsin Energy Statistics – 1999 indicates that Wisconsin electric utilities received 23.4 million tons of coal in 1998 with an average sulfur content of 0.46%, and an average heat content of 9,299 Btu/lb. Almost exclusively through the use of these low sulfur subbituminous coals, Wisconsin utilities have been able to reduce SO_2 emissions to an average of about 0.9 lb/mmBtu. While this emission rate is substantially less than historical levels, it is still more than 4 times higher than the allowable emission rate for the ESM Energy Center because almost none of Wisconsin's coal-fired capacity has flue gas desulfurization systems (scrubbers), an integral part of the ESM Energy Center.

In the original air pollution control permit application for this facility, the applicant applied for approval to combust coal as a secondary fuel. However, because the applicant and the Department were unable to reach agreement on the appropriate SO_2 emission limits for coal combustion, the applicant withdrew coal from the potential fuels for this facility.

4.3.6 Wind Energy

According to the American Wind Energy Association, Wisconsin currently has 22.98 MW of installed wind energy capacity. In 1999, Madison Gas & Electric Company installed seventeen 660 kW wind generators in Kewaunee County for a total wind farm capacity of 11.22 MW. Wisconsin Public Service Corp. added 14 turbines of the same model nearby. This is currently the largest wind farm in the eastern United States, and is expected to produce electric power at a cost of about $0.09 per kWh. The size of the wind farm is 603 acres.

Last summer, Alliant Energy and Wisconsin Electric Power Company canceled plans to participate in a wind farm near Addison in Washington County. This wind farm was proposed to be 29.7 MW in capacity and was scheduled to come on-line in 2001. The utilities canceled participation in this project largely due to public concerns including aesthetics, noise, and bird mortality.

Wind energy was not a serious consideration for this project, both because wind energy cannot provide steam for municipal and industrial steam customers, nor can wind energy provide a, consistent baseload electric power source. With respect to the latter issue, some have argued that windfarms should be viewed only as fuel savers, and should be given no credit for adding new capacity to electric utility systems. This is because wind is intermittent, and cannot be "dispatched" as can conventional electric generating capacity. However, a study by the Tellus Institute of Boston, Mass. in 1993 concluded that the average capacity value for wind is 23%. Based on this conclusion, a wind farm would need to have a capacity of approximately 430 MW to achieve the same capacity addition as the proposed ESM Energy Center. Based on an estimated windfarm size of 50 acres per MW, this would require 21,500 acres of land. This additional wind capacity would be almost 20 times more than the current wind capacity in the entire state. Even under this scenario, however, wind generation by itself cannot provide the necessary baseload power for the City of Manitowoc. While wind energy does have proven and effective applications for meeting some electric capacity requirements, it is not feasible to utilize wind for supplying the energy needs for the City of Manitowoc.

As noted above, MGE's wind farm generating cost is estimated at $0.09 per kWh. This cost is more than twice as high as the estimated energy cost for the proposed ESM Energy Center. Therefore, a wind farm is neither a technically feasible alternative to the proposed ESM Energy Center, nor an economically feasible alternative.

FIGURES

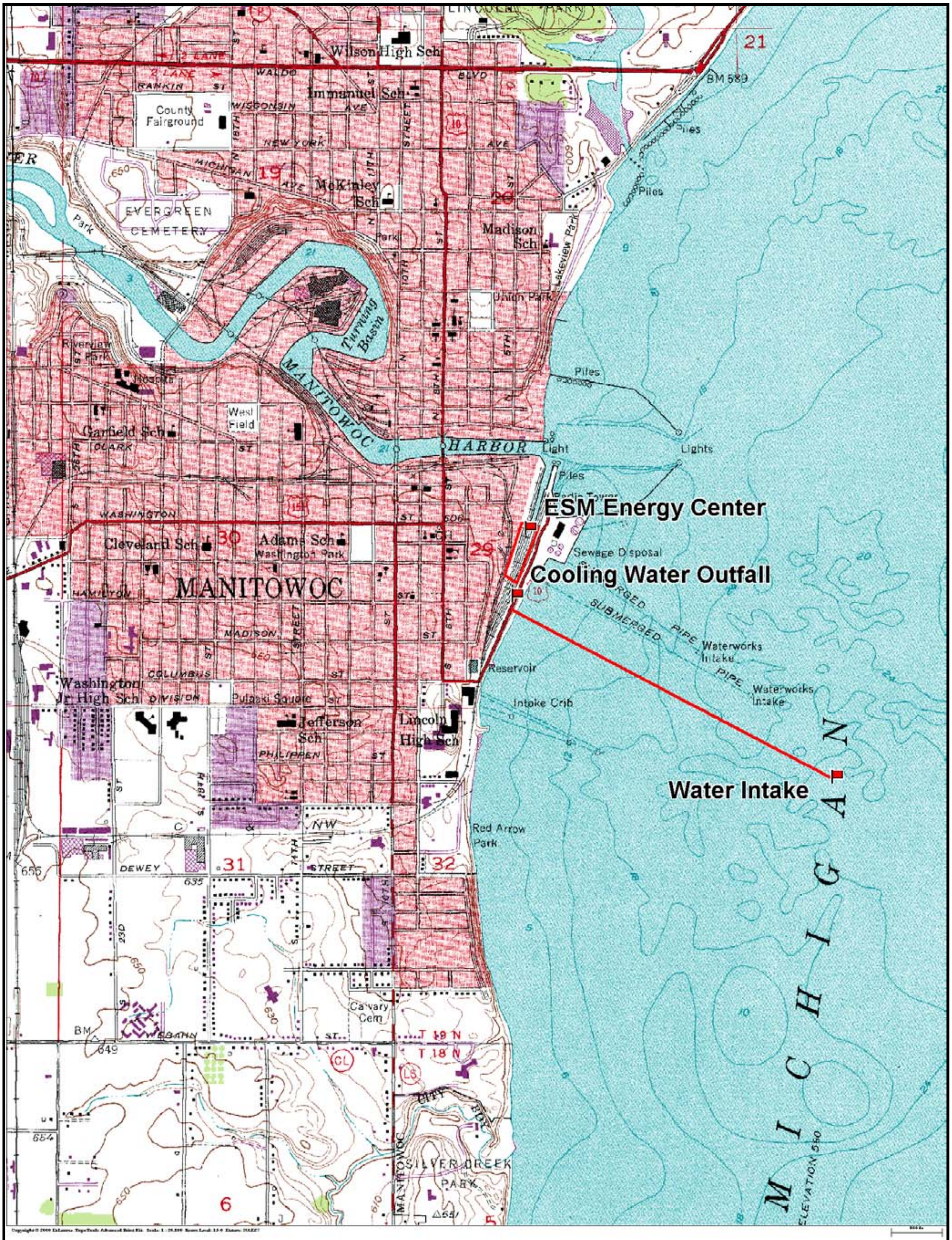


FIGURE 1. Facility site location map for the Energy Services of Manitowoc electric generating station.

1600 ft

Adapted from the USGS 7.5 minute Manitowoc, Wisconsin topographic map, 1973.

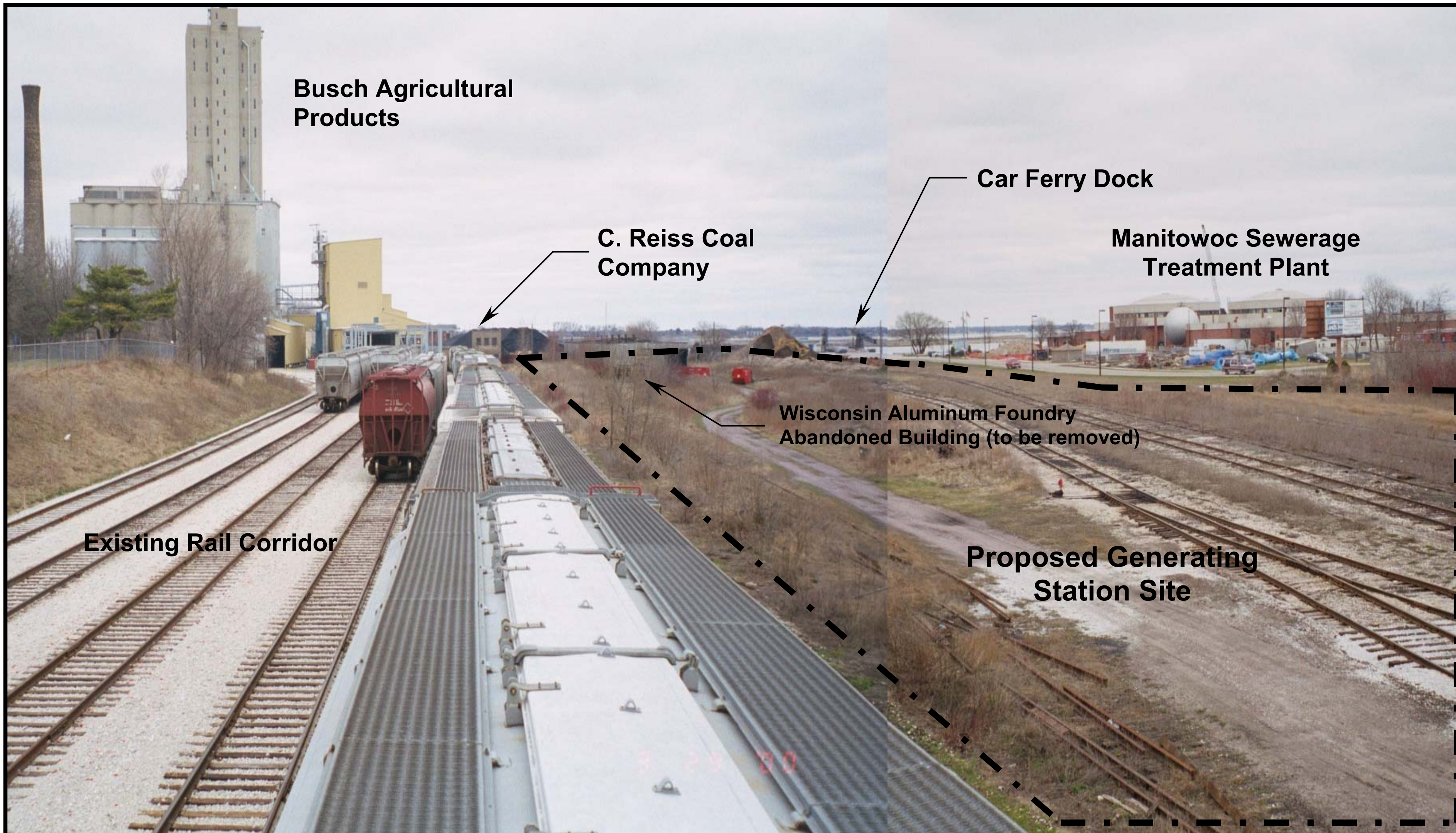
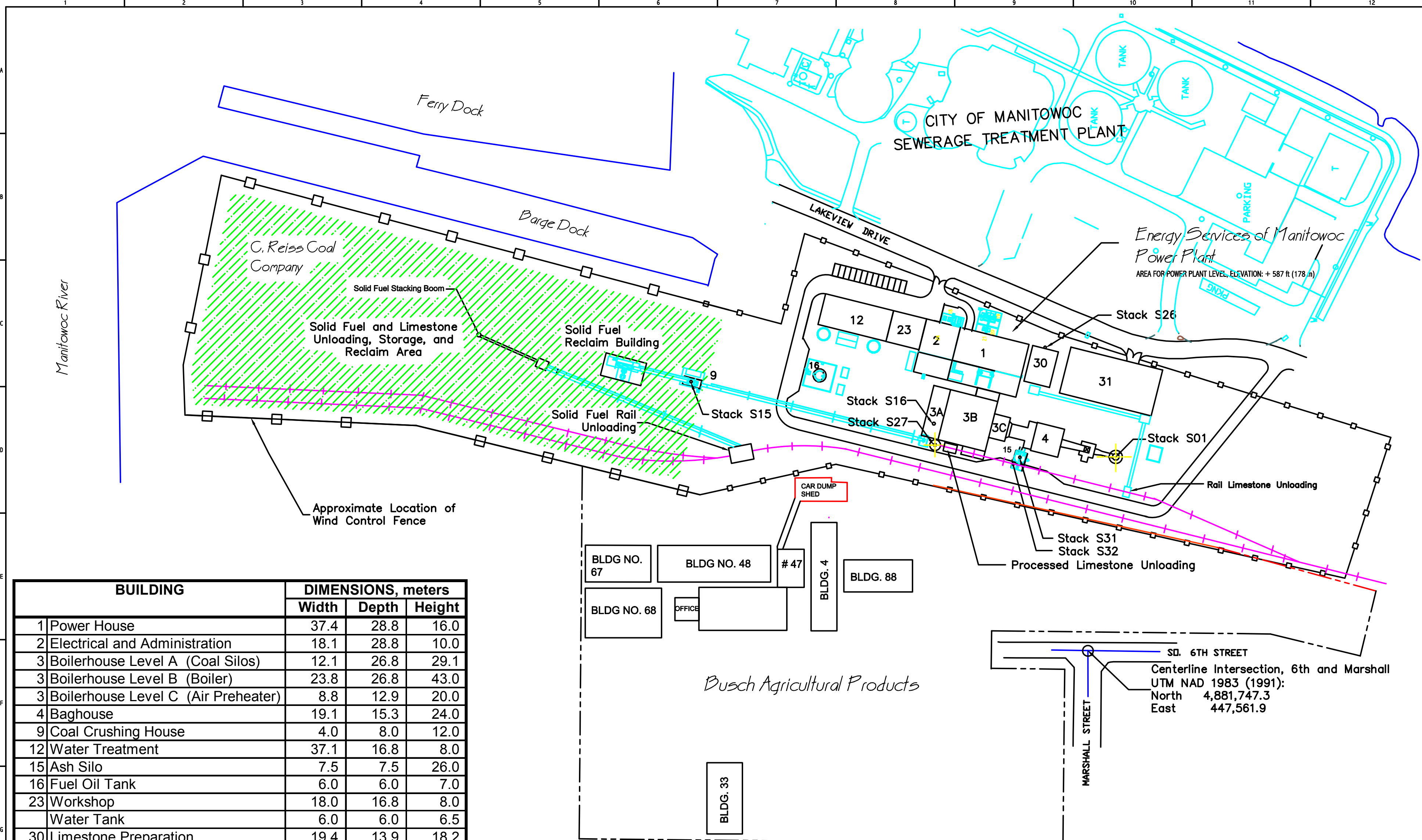


FIGURE 2a. Photo of the existing site for the proposed Energy Service of Manitowoc Energy Center, showing the existing buildings on site, the existing railroad corridor, and neighboring industries.

Site Boundary (Approximate)

FIGURE 2b. Photo of the existing rail corridor and proposed electric transmission route from the proposed Energy Service of Manitowoc Energy Center to the Manitowoc Public Utilities facility.



BUILDING		DIMENSIONS, meters		
		Width	Depth	Height
1	Power House	37.4	28.8	16.0
2	Electrical and Administration	18.1	28.8	10.0
3	Boilerhouse Level A (Coal Silos)	12.1	26.8	29.1
3	Boilerhouse Level B (Boiler)	23.8	26.8	43.0
3	Boilerhouse Level C (Air Preheater)	8.8	12.9	20.0
4	Baghouse	19.1	15.3	24.0
9	Coal Crushing House	4.0	8.0	12.0
12	Water Treatment	37.1	16.8	8.0
15	Ash Silo	7.5	7.5	26.0
16	Fuel Oil Tank	6.0	6.0	7.0
23	Workshop	18.0	16.8	8.0
	Water Tank	6.0	6.0	6.5
30	Limestone Preparation	19.4	13.9	18.2
31	Limestone Unloading Building	50.0	25.0	15.2
Busch Agricultural Products				
4	Elevator No. 1	13.7	57.4	22.7
33	Elevator No. 6	18.8	37.7	30.3
47	Workhouse	14.1	20.2	54.5
48	Elevator No. 3	59.8	19.4	30.3
67	Elevator No. 4	40.4	19.4	28.8
68	Elevator No. 5	40.4	26.3	34.8
88	Elevator No. 2	36.4	17.0	30.3

Prepared By:

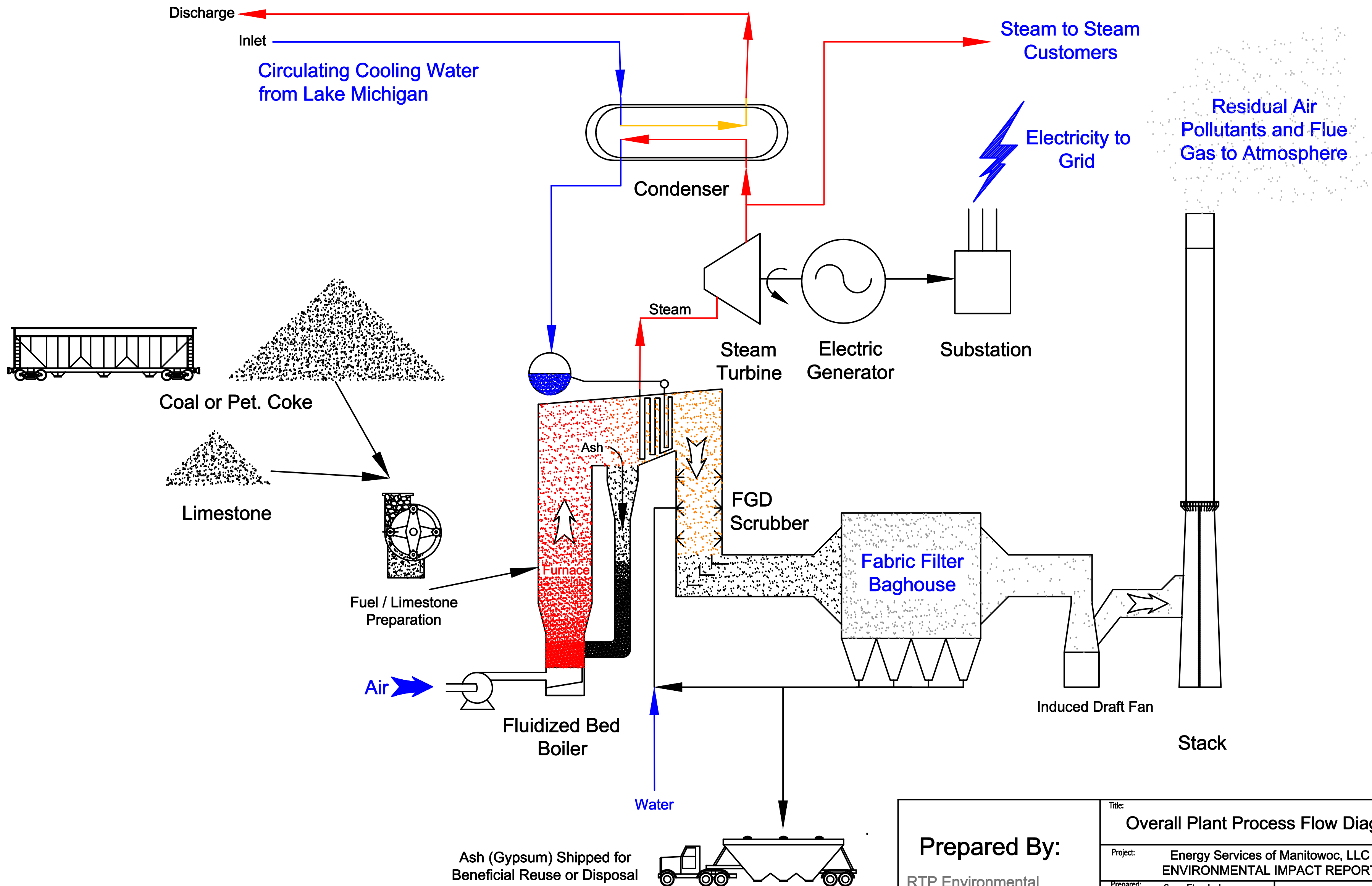
RTP Environmental Associates, Inc.
18432 State Highway 21
Tomah, Wisconsin 54660
608 374 4488

Title: Plant layout, Building Dimensions, and Stack locations

Project: Energy Services of Manitowoc
ENVIRONMENTAL IMPACT REPORT

Prepared: Greg Eirschele
Checked:
Scale:
Date: 04/11/2001
Project No.:

FIGURE 3



Prepared By:

RTP Environmental
Associates, Inc.
18432 State Highway 21
Tomah, Wisconsin 54660
608 374 4488

Title:	Overall Plant Process Flow Diagram
Project:	Energy Services of Manitowoc, LLC ENVIRONMENTAL IMPACT REPORT
Prepared:	Greg Eirschele
Checked:	
Scale:	None
Date:	4/11/2001
Project No.:	C17701

FIGURE
4

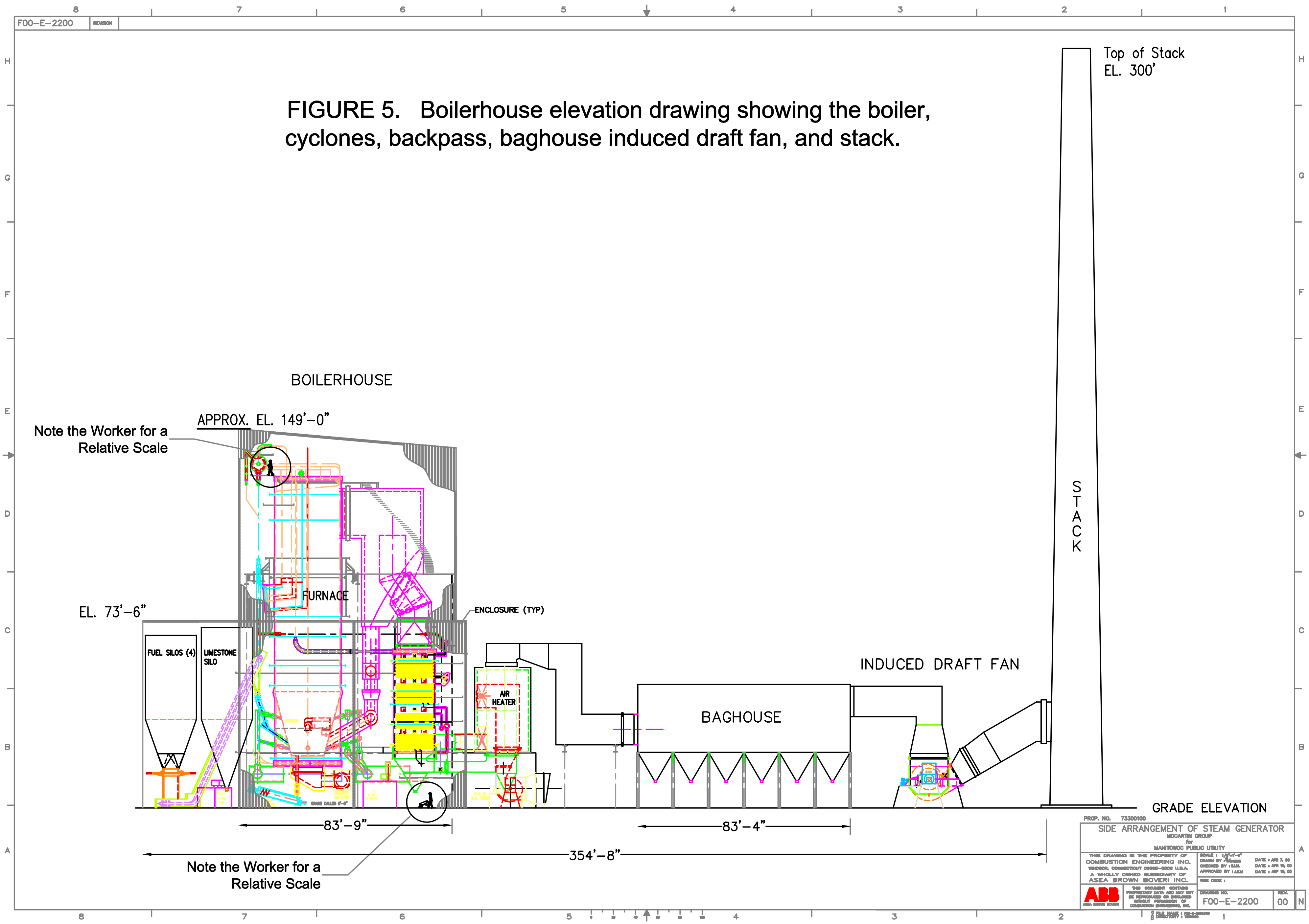
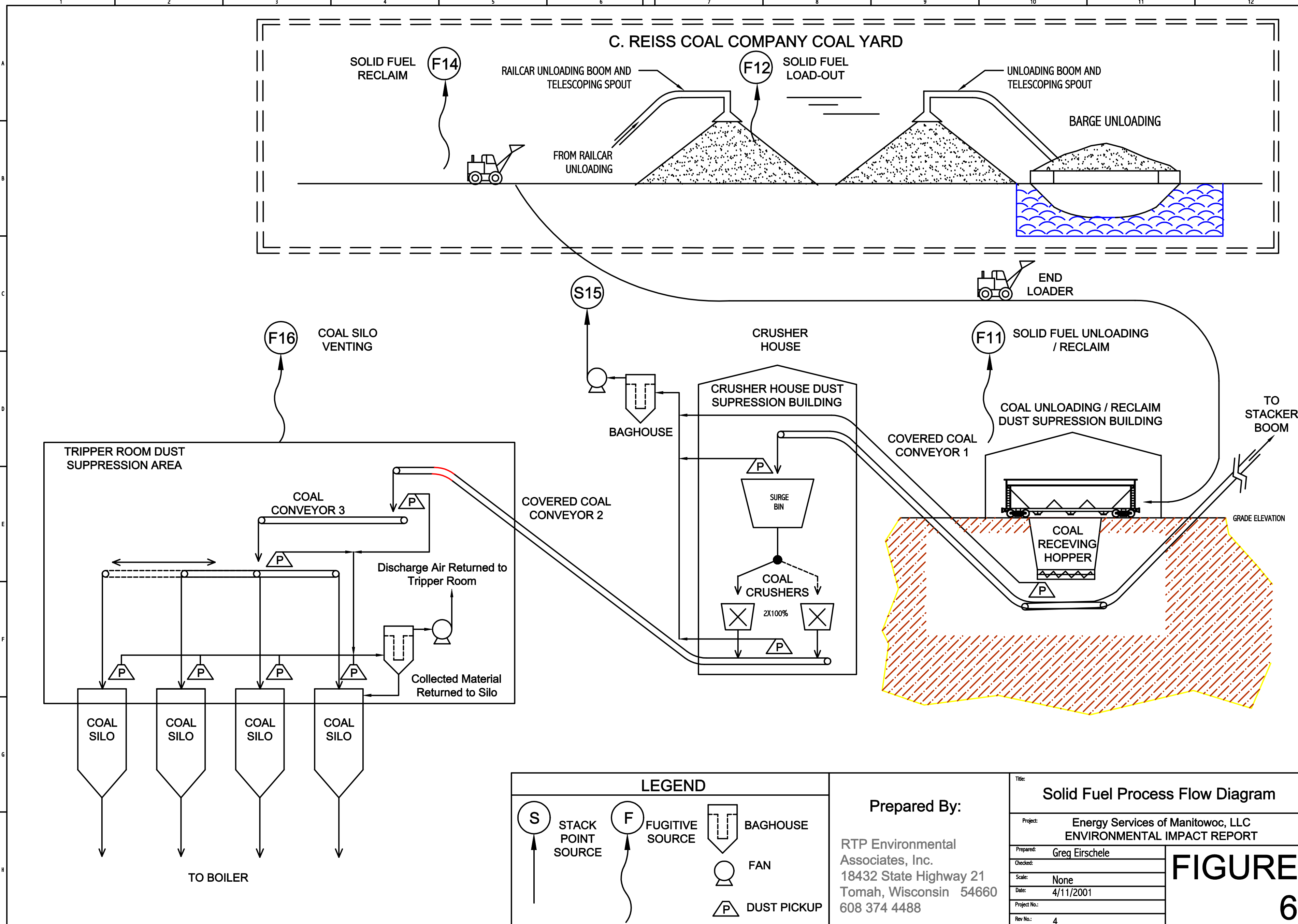


FIGURE 5. Boilerhouse elevation drawing showing the boiler, cyclones, backpass, baghouse induced draft fan, and stack.



Prepared By:

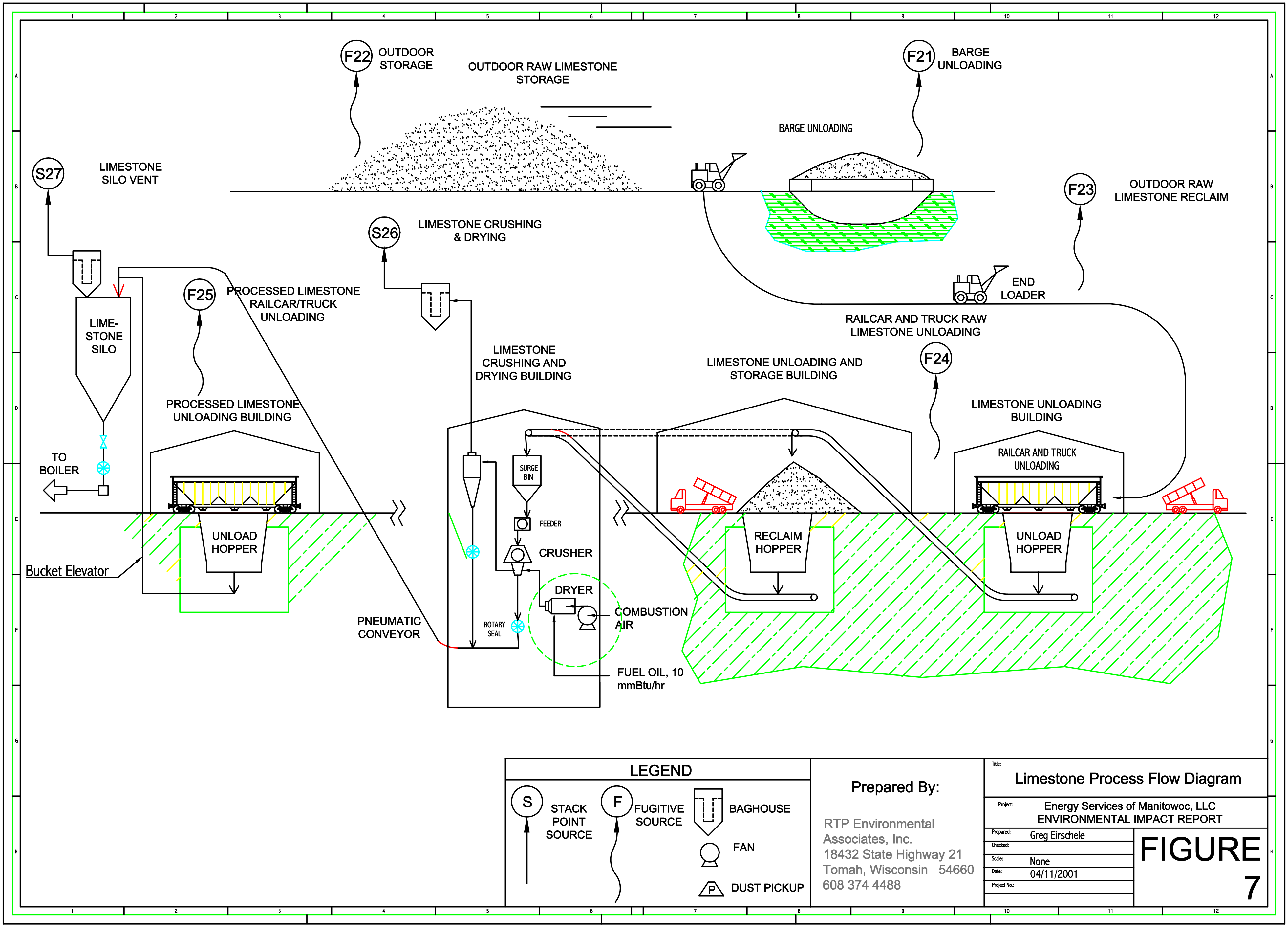
RTP Environmental Associates, Inc.
18432 State Highway 21
Tomah, Wisconsin 54660
608 374 4488

Title: Solid Fuel Process Flow Diagram

Project: Energy Services of Manitowoc, LLC ENVIRONMENTAL IMPACT REPORT

Prepared: Greg Eirschele
Checked:
Scale: None
Date: 4/11/2001
Project No.:
Rev No.: 4

FIGURE 6


F22 OUTDOOR STORAGE
OUTDOOR RAW LIMESTONE STORAGE
F21 BARGE UNLOADING
BARGE UNLOADING
S27 LIMESTONE SILO VENT
F23 OUTDOOR RAW LIMESTONE RECLAIM
S26 LIMESTONE CRUSHING & DRYING
END LOADER
F25 PROCESSED LIMESTONE RAILCAR/TRUCK UNLOADING
LIME-STONE SILO
RAILCAR AND TRUCK RAW LIMESTONE UNLOADING
LIMESTONE CRUSHING AND DRYING BUILDING
LIMESTONE UNLOADING AND STORAGE BUILDING
F24
PROCESSED LIMESTONE UNLOADING BUILDING
LIMESTONE UNLOADING BUILDING
RAILCAR AND TRUCK UNLOADING
TO BOILER
SURGE BIN
FEEDER
CRUSHER
UNLOAD HOPPER
RECLAIM HOPPER
UNLOAD HOPPER
Bucket Elevator
DRYER
COMBUSTION AIR
PNEUMATIC CONVEYOR
ROTARY SEAL
FUEL OIL, 10 mmBtu/hr
LEGEND
S STACK POINT SOURCE
F FUGITIVE SOURCE
BAGHOUSE
FAN
P DUST PICKUP
Prepared By:
RTP Environmental Associates, Inc.
18432 State Highway 21
Tomah, Wisconsin 54660
608 374 4488
Title: Limestone Process Flow Diagram
Project: Energy Services of Manitowoc, LLC
ENVIRONMENTAL IMPACT REPORT
Prepared: Greg Eirschele
Checked:
Scale: None
Date: 04/11/2001
Project No.:
FIGURE 7

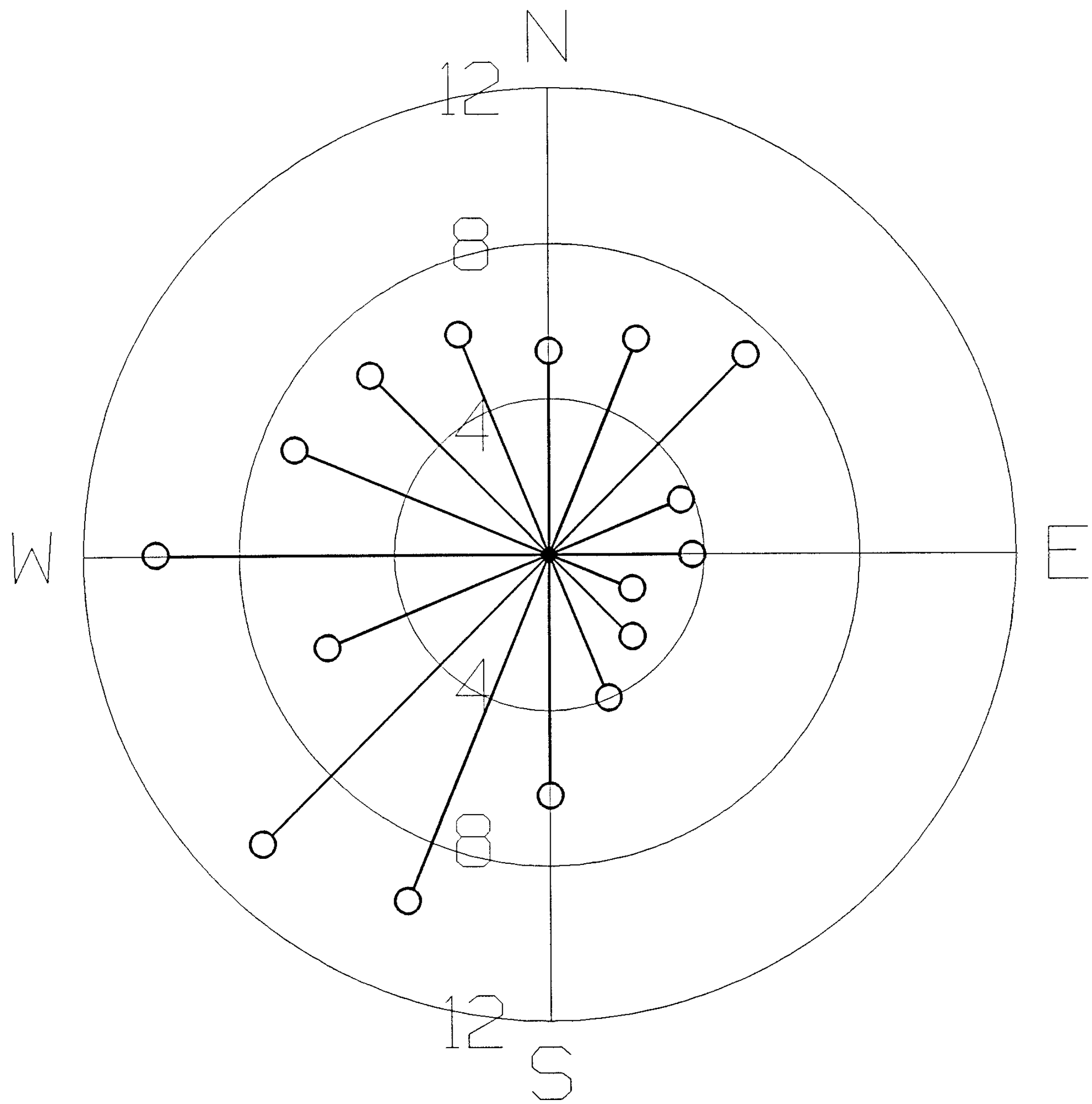
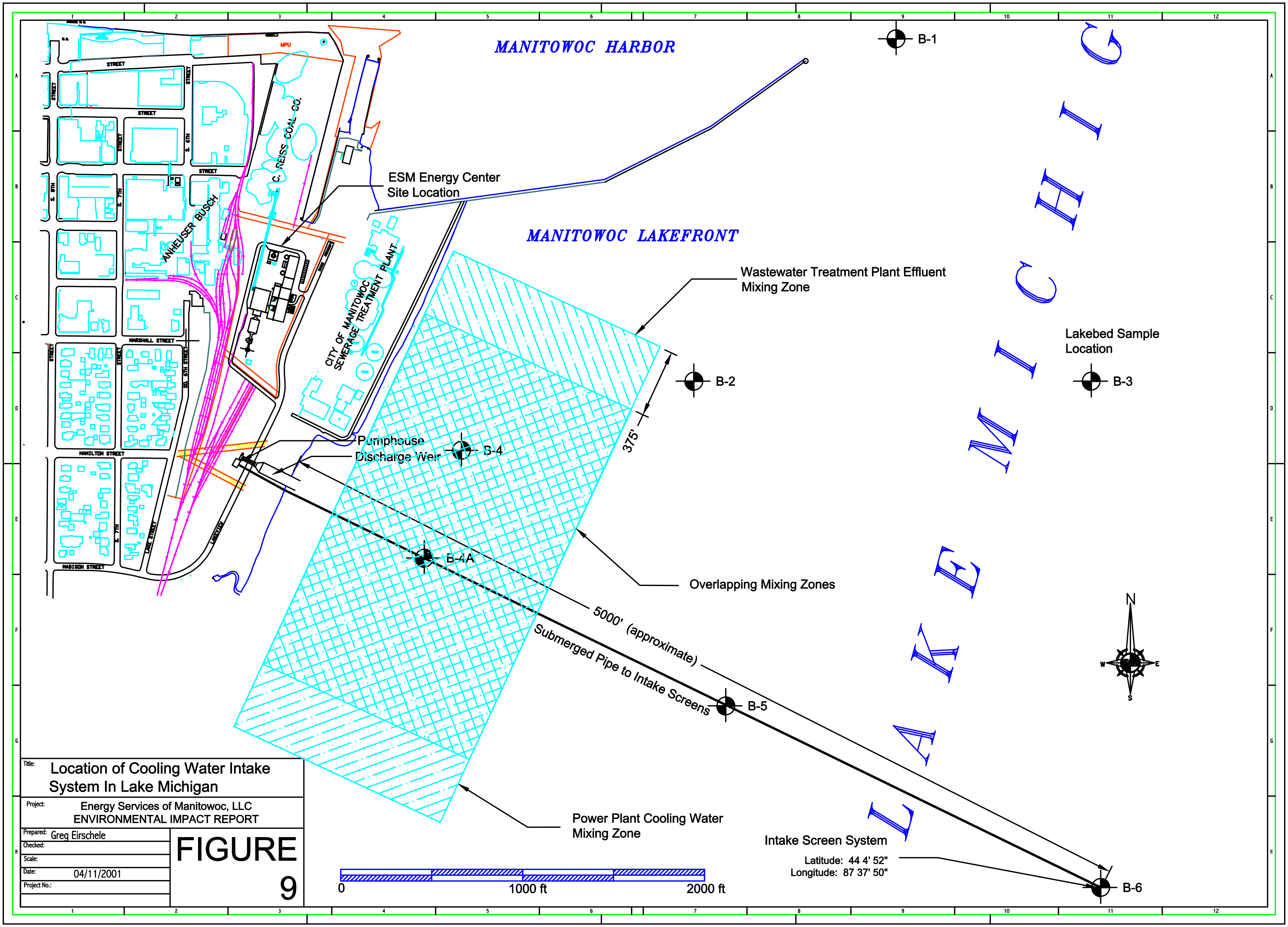
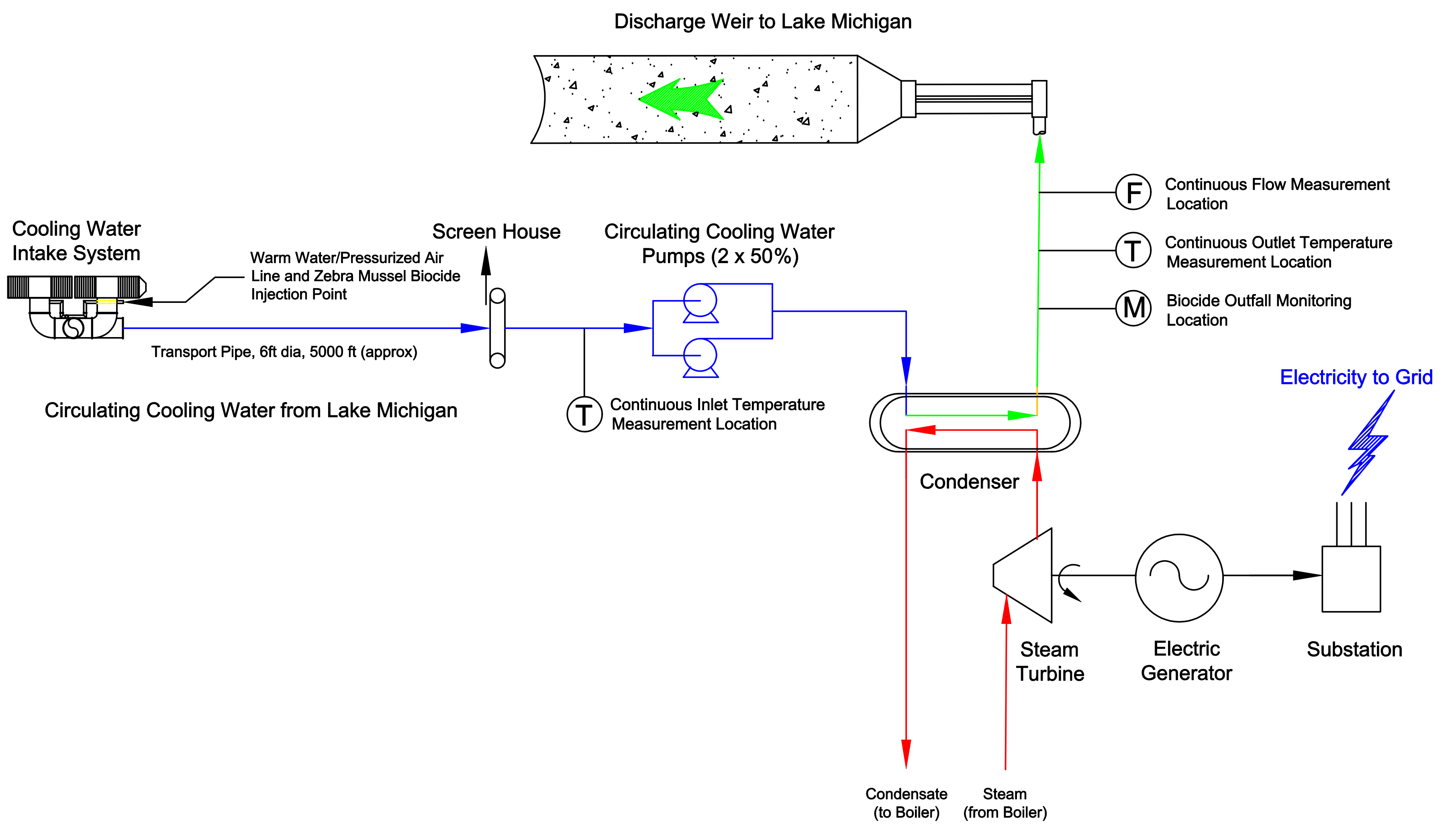


FIGURE 8. Wind rose for Green Bay, Wisconsin showing annual wind frequency by percent. Source: State climatologist.


MANITOWOC HARBOR
MANITOWOC LAKEFRONT
LAKE MICHIG
B-1
B-2
B-3
B-4
B-4A
B-5
B-6
ESM Energy Center
Site Location
C. REISS COAL CO.
ANHEUSER BUSCH
CITY OF MANITOWOC
SEWERAGE TREATMENT PLANT
Wastewater Treatment Plant Effluent
Mixing Zone
Lakebed Sample
Location
375'
Pumphouse
Discharge Weir
Overlapping Mixing Zones
5000' (approximate)
Submerged Pipe to Intake Screens
Power Plant Cooling Water
Mixing Zone
Intake Screen System
Latitude: 44 4' 52"
Longitude: 87 37' 50"
0
1000 ft
2000 ft
N
W
E
S
Title:
Location of Cooling Water Intake
System In Lake Michigan
Project:
Energy Services of Manitowoc, LLC
ENVIRONMENTAL IMPACT REPORT
Prepared: Greg Eirschele
Checked:
Scale:
Date: 04/11/2001
Project No.:
FIGURE
9



Prepared By:

RTP Environmental Associates, Inc.
18432 State Highway 21
Tomah, Wisconsin 54660
608 374 4488

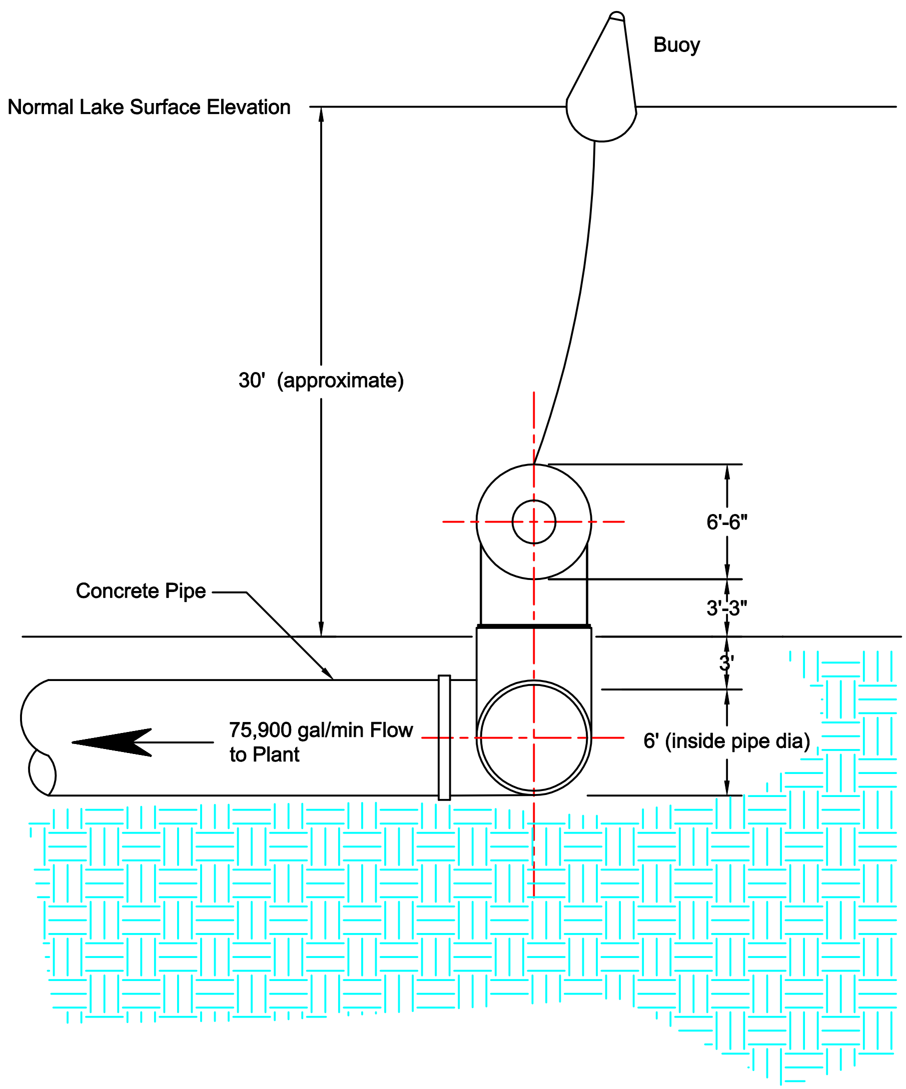
Title: Cooling Water Process Flow Diagram

Project: Energy Services of Manitowoc, LLC
ENVIRONMENTAL IMPACT REPORT

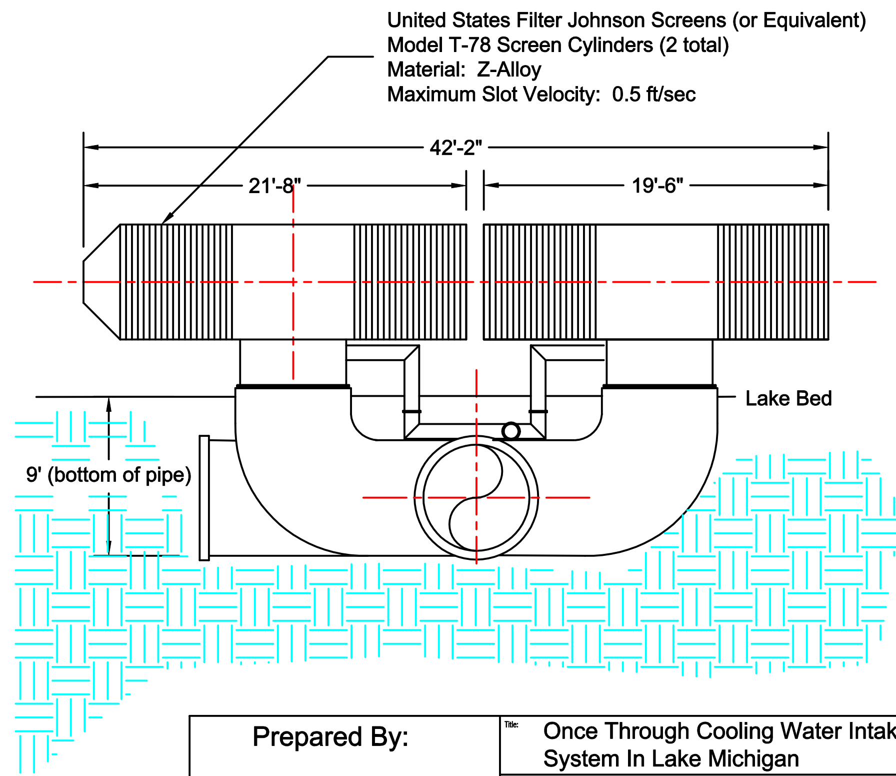
Prepared: Greg Eirschele
Checked:
Scale: None
Date: 4/12/2001
Project No.:

FIGURE 10

SIDE VIEW



FRONT VIEW

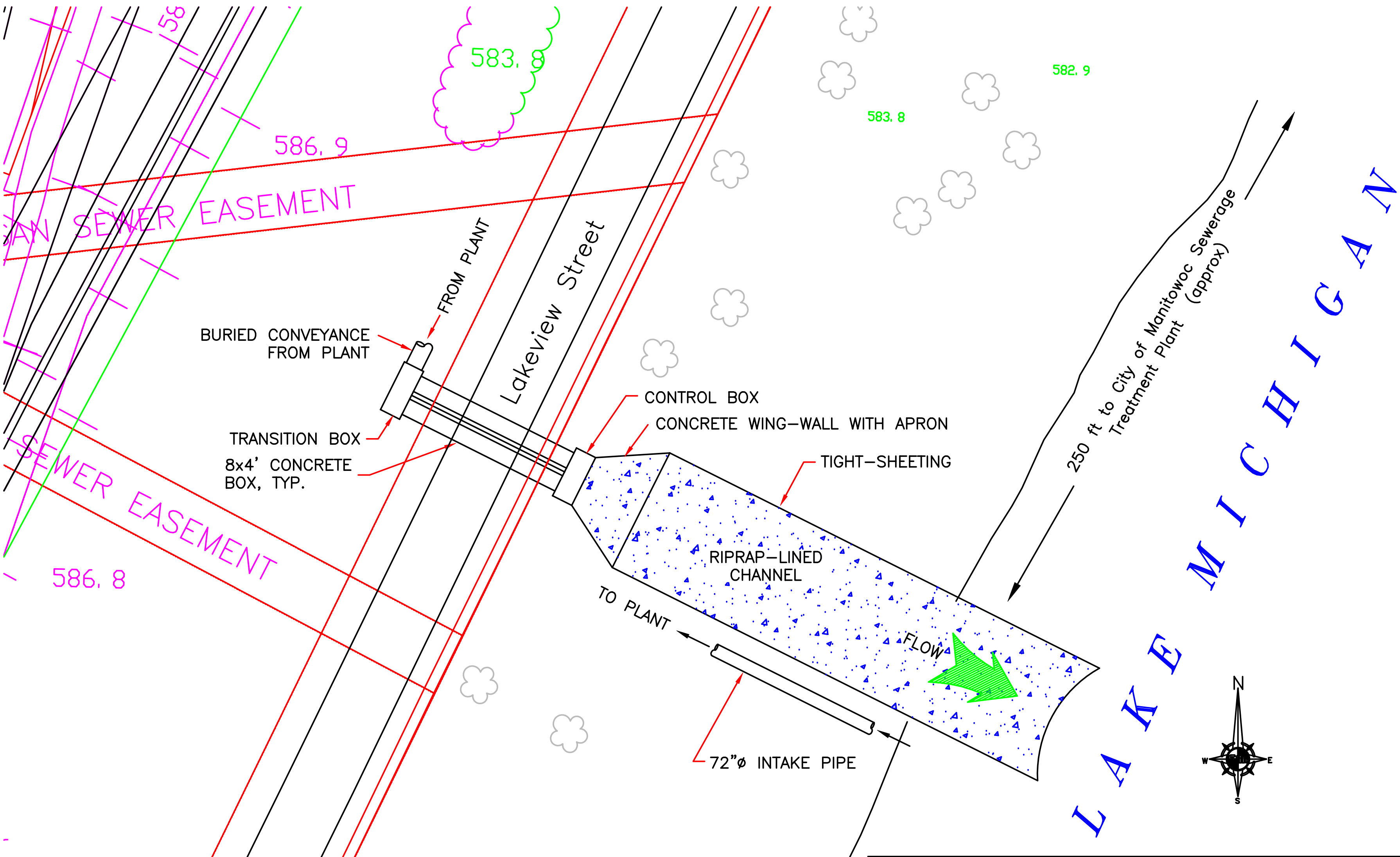


Prepared By:

RTP Environmental
Associates, Inc.
18432 State Highway 21
Tomah, Wisconsin 54660
608 374 4488

Title:	Once Through Cooling Water Intake System In Lake Michigan
Project:	Energy Services of Manitowoc, LLC ENVIRONMENTAL IMPACT REPORT
Prepared:	Greg Eirschele
Checked:	
Scale:	
Date:	4/12/2001
Project No.:	

FIGURE
11



Prepared By:

RTP Environmental Associates, Inc.
18432 State Highway 21
Tomah, Wisconsin 54660
608 374 4488

Title:	Cooling Water Discharge Weir
Project:	Energy Services of Manitowoc, LLC ENVIRONMENTAL IMPACT REPORT
Prepared:	Greg Eirschele
Checked:	
Scale:	None
Date:	4/12/2001
Project No.:	

FIGURE 12

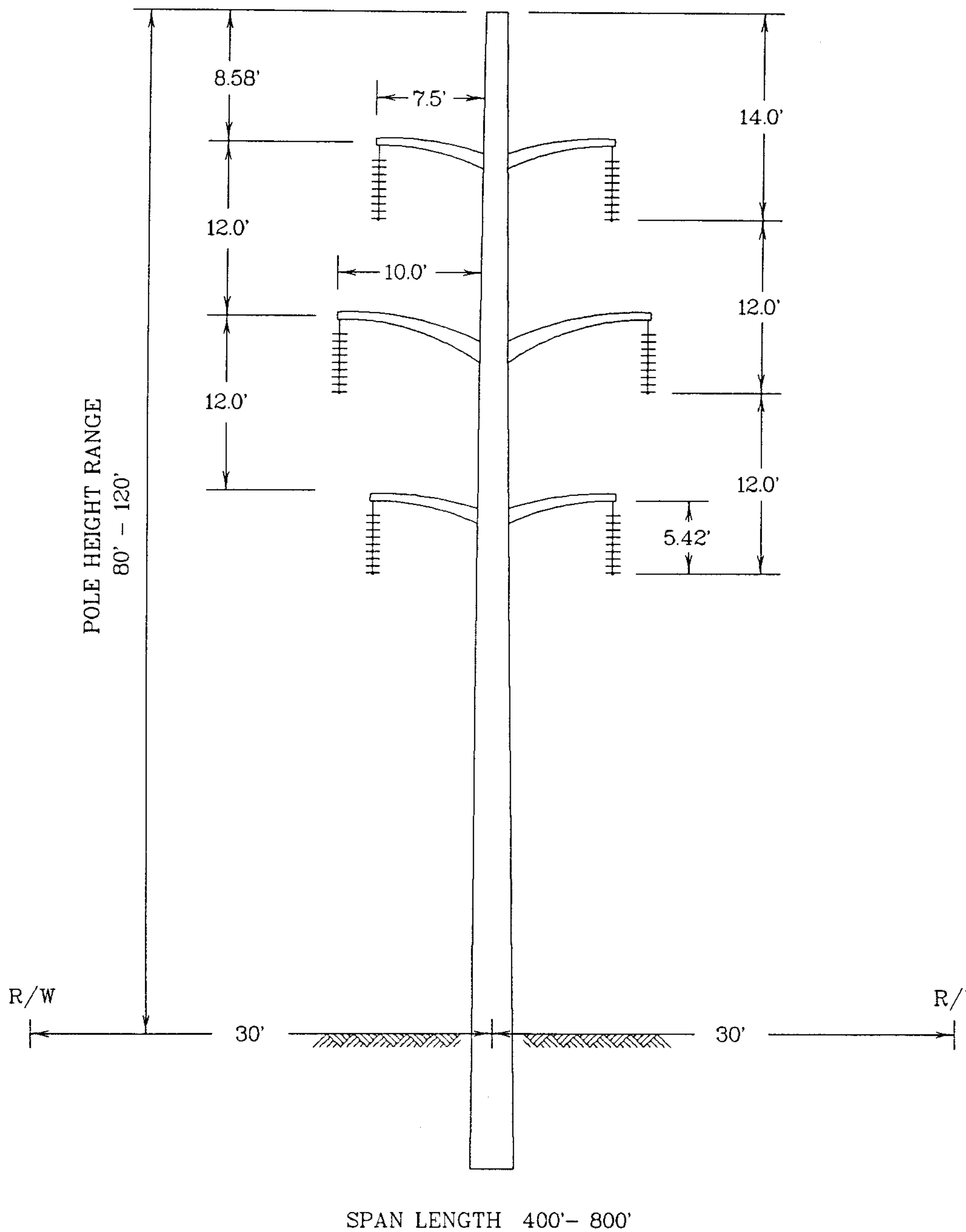


FIGURE 13. Typical 138,000 volt double circuit transmission line structure.

Appendix A. Threatened and Endangered Species response letters from the United States Department of the Interior, Fish and Wildlife Service and the Wisconsin Department of Natural Resources, Bureau of Endangered Resources.

MAY 1 5 2000

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Green Bay ES Field Office
1015 Challenger Court
Green Bay, Wisconsin 54311-8331
Telephone 920/465-7440
FAX 920/465-7410

May 10, 2000

Mr. Greg Eirschele, P.E.
Applied Environmental Sciences, Inc.
2110 Luann Lane
Madison, Wisconsin 53713-3074

re: Proposed Electric Generating Facility
City of Manitowoc
Manitowoc County, Wisconsin

Dear Mr. Eirschele:

The U.S. Fish and Wildlife Service has received your letter dated April 18, 2000, requesting comments on the subject project. Due to staff time constraints and priority work activities, we are able to only review your project for potential impacts to federally-listed threatened and endangered species or those proposed for listing. Be advised that other environmental concerns may be associated with this project such as wetland and stream impacts, erosion control needs, and effects on state-listed threatened or endangered species. State or federal permits may be needed, as well, if stream or wetland impacts will occur. If resource impacts are expected to occur, we recommend that you forward this project to the appropriate Wisconsin Department of Natural Resources office for their review.

Please provide us copies of any future review documents that may be associated with this project or of future projects you may be planning that would require Service review. This will allow us to keep our files current. We will provide comments as time and work priorities allow.

Federally-Listed and Proposed Threatened and Endangered Species

A review of information in our files indicates that the following federally-listed and proposed threatened or endangered species occur in Manitowoc County:

Classification	Common Name	Scientific Name	Habitat
threatened	Pitcher's thistle	Cirsium pitcheri	stabilized dunes, and blowout areas

Due to the nature and location of the proposed activities, we conclude that the above listed species will not be affected. This precludes the need for further action on this project as required by the 1973 Endangered Species Act, as amended. Should the project be modified or new information become available that indicates listed or proposed species may be affected, consultation should be initiated.

We appreciate the opportunity to respond. Questions pertaining to these comments can be directed to Mr. Joel Trick by calling 920-465-7416.

Sincerely,

Janet M. Smith

Janet M. Smith
Field Supervisor

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Tommy G. Thompson, Governor
George E. Meyer, Secretary

101 S. Webster St.
Box 7921
Madison, Wisconsin 53707-7921
Telephone 608-266-2621
FAX 608-267-3579
TDD 608-267-6897

June 12, 2000

Mr. Greg Eirschele
Applied Environmental Sciences, Inc.
2110 Luann Lane
Madison, WI 53713

SUBJECT: Endangered Resources Review, (Log Number 00-068)

Dear Mr. Eirschele:

The Bureau of Endangered Resources has reviewed the project area described in your letter of April 14, 2000 for the proposed electric generating facility in Manitowoc, Wisconsin.

Our Natural Heritage Inventory (NHI) data files contain no recent occurrence records of Endangered, Threatened, or Special Concern species or natural communities, nor of any State Natural Areas for the project area.

Although there are no records in the NHI database of endangered resources occurring at the project site, comprehensive endangered resource surveys have not been completed for the project area. As a result, our data files may be incomplete. However, given your description of the project site and the nature of the proposed project I do not believe that further surveys are warranted.

This letter is for informational purposes and only addresses endangered resource issues. This letter does not constitute Department of Natural Resources authorization of the proposed project and does not exempt the project from securing necessary permits and approvals from the Department.

Please be sure to include a legal description of the area for which you are requesting information in any future requests. Thank you.

Please contact me at (608) 266-8736 if you have any questions about this information.

Sincerely,

Cathy Bleser

Cathy A. Bleser
Bureau of Endangered Resources

Appendix B. Summary of An Archeological Survey of 5.5 Acres on S. Lakeview Drive for an Electric Generating Power plant in the City of Manitowoc, Manitowoc County, Wisconsin, Robert P. Fay, Old Northwest Research, Two Rivers, Wisconsin.

AN ARCHAEOLOGICAL SURVEY OF 5.5 ACRES ON S. LAKEVIEW DRIVE FOR AN ELECTRICAL GENERATING FACILITY IN THE CITY OF MANITOWOC, MANITOWOC COUNTY, WISCONSIN

Prepared for: Applied Environmental Sciences, Inc.
ATTN:Greg Eirschele
2110 LuAnn Lane
Madison, Wisconsin 53713
(608) 277-9933
(608) 277-9939 FAX

Prepared by: Robert P. Fay

Robert P. Fay
Old Northwest Research
2312 Jefferson Street
Two Rivers, Wisconsin 54241-2208
(920) 793-1338

Old Northwest Research
Report No. 39

March 27, 2000

MANAGEMENT SUMMARY

A Phase I archaeological survey of a proposed electrical generating facility on 5.5 acres on S. Lakeview Drive (USH 10), across from the Manitowoc wastewater treatment plant and south of the Lake Michigan Car Ferry dock on Manitowoc's south lakefront, was conducted by Old Northwest Research in October and November of 1999.

The purpose of the survey was to locate and evaluate the significance of any archaeological sites that might be present where a 99-megawatt solid fuel electric power plant will be constructed and privately owned and operated by the McCartin Group of Hammond, Indiana.

Archival research and archaeological field survey methods including surface inspection and shovel testing were conducted.

The historical research and archaeological field investigations by Old Northwest Research found: (1) no evidence of any prehistoric or historic Native American occupation or use on the property; (2) several historic materials and debris of recent origin during surface inspection; (3) a total of 426 historic artifacts dating from the modern period during shovel testing; (4) four buildings that no longer retain historical or architectural integrity for nomination to the National Register of Historic Places; and (5) heavily disturbed soils resulting from previous industrial land use activities on the property including railroad track construction, coal dock operations, shipping and storage, underground utilities and recent land use activities.

Given these findings, the proposed development area warrants no further archival, historical or archeological research.

Notes, maps, photographs, artifacts and other documentation resulting from this study are on file at Old Northwest Research in Two Rivers, Wisconsin.

TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

This report summarizes the results of a Phase I archaeological and historical survey of 5.5 acre parcel of land along S. Lakeview Drive (USH 10) where a proposed electrical generating facility will be constructed in the city of Manitowoc, Manitowoc County, Wisconsin.

The purpose of the cultural investigations was to find and evaluate any evidence of prehistoric or historic archaeological sites that might be present where the new power plant facility is planned.

Applied Environmental Sciences' (AES) decision to have an archaeological survey of the property was part of the environmental impact study of the project area. The development project did not have a compliance number assigned by the State Historical Society of Wisconsin at the time of the survey.

Authorization to conduct the archaeological field investigations and historical research, as described in the request for proposal (RFP) and a written proposal submitted by Old Northwest Research on September 27, 1999, was received from Greg Eirschele, AES senior engineer, on September 30, 1999 (Appendix A). The author conducted three (3) days of field work on October 14 and November 26 and 27, 1999. Maps on file at the City of Manitowoc Plan Commission office were consulted on October 14, 1999. Archival materials and records at the State Historical Society of Wisconsin, Madison, were examined on October 22, 1999. Additional property maps were examined at the Wisconsin Central Railroad real estate office, Green Bay, on December 9, 1999.

PROJECT LOCATION AND DESCRIPTION

The McCartin Group of Hammond, Indiana plans to construct an electric generating facility on 5.5 acres of land along S. Lakeview Drive, across from the Manitowoc wastewater treatment plant, on Manitowoc's south lakefront (Figures 1-2). The project area extends over parts of city blocks 235, 280, 281 and 282 and portions of vacated Washington, Hancock and Marshall Streets.

The property is currently owned by the Wisconsin Central Railroad. It is bordered on the east by S. Lakeview Drive (USH 10), on the west and south by Wisconsin Central Railroad tracks, and on the north by the C. Reiss Coal Company unloading/storage facility, docks and boat slip and the Lake Michigan Carferry Service ticket office and parking lot. The proposed building footprint will be toward the north end of the site, south of the Reiss Co. coal yard and east of a rail car unloading facility at Busch Agricultural Resources. The property is zoned I-2 Heavy Industrial.

The legal description of the property is the NW 1/4 of the SW 1/4 of the SE 1/4 of the SE 1/4, the NW 1/4 of the SE 1/4 of the SW 1/4 of the SW 1/4, the SW 1/4 of the NW 1/4 of the NE 1/4, and the SW 1/4 of the NE 1/4 of the NW 1/4 of fractional Section 29, Township 19 North, Range 24 East.

The 99-megawatt solid fuel electric power plant will be privately owned and operated by the McCartin Group. The plant will augment power produced by Manitowoc Public Utilities (MPU).

Appendix C. Response letter from the State Historical Society of Wisconsin regarding the Archeological Survey of 5.5 Acres on S. Lakeview Drive for an Electric Generating Power plant in the City of Manitowoc, Manitowoc County, Wisconsin.

SEP 18 2000

State Historical Society of Wisconsin
816 State Street ♦ Madison, Wisconsin 53706-1482 ♦ 608/264-6400 ♦ Fax: 264-6504

Division of Historic Preservation
608/264-6500

September 14, 2000

Mr. Gregory J. Eirschele
Applied Environmental Sciences, Inc.
2110 Luann Lane
Madison, WI 53713-3074

IN REPLY PLEASE REFER TO
SHSW COMPLIANCE CASE #00-1466/MN

RE: Energy Services Of Manitowoc (ESM) 99 MW Electric Generating Facility

Dear Mr. Eirschele:

We have reviewed the archeological report titled *"An Archaeological Survey of 5.5 Acres on S. Lakeview Drive for an Electrical Generating Facility in the City of Manitowoc, Manitowoc County, Wisconsin"*, prepared by Robert P. Fay.

The survey procedures utilized were sufficiently thorough to justify the conclusion that there are no archeological resources eligible for inclusion on the National Register of Historic Places within the areas surveyed.

It is always possible that deeply buried archeological sites may be found during construction. If such finds are made, please contact our office at (608) 264-6507. Should burials be discovered during construction, you must contact our office immediately for compliance with Wis. Stat. §157.70 (1991), which provides for the protection of human burial sites.

There are no architectural properties listed in the National Register of Historic Places located within the area of potential effect of the proposed undertaking. Furthermore, we are not aware of any properties that may be eligible for listing in the National Register of Historic Places in this area.

Should you have questions concerning this matter, please contact me at (608) 264-6507.

Sincerely,

Sherman Banker

Sherman J. Banker
Compliance Archeologist

SJB/DJD/djd
cc: Robert P. Fay

Appendix D. Chart 8 from the NOAA Lake Survey, Marine Studies Center, Sea Grant Institute at the University of Wisconsin – Madison, Lake Chart 14903.

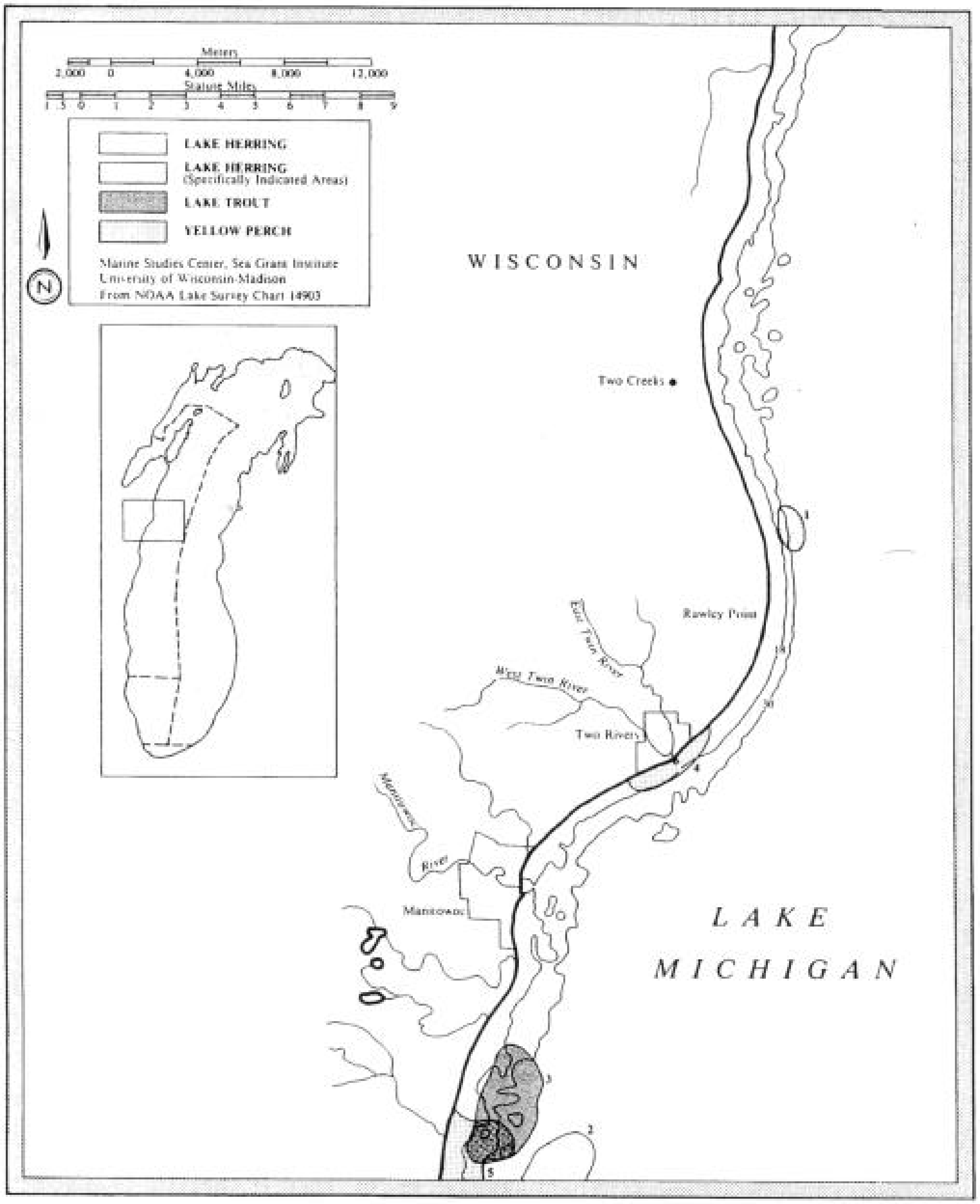


CHART 8

Lake Michigan: Manitowoc Area (from NOAA Lake Chart 14903)

This chart covers the northern quarter of Ground 6. Twelve fishermen were interviewed who fished in Ground 6; occasionally fishermen from Ground 5 would fish Ground 6. Their combined fishing experience covers 1905 to the present.

■ SPAWNING AREAS FOR CHART 8

1. RAWLEY POINT: Lake herring.
   Referred to by one fisherman who fished pound nets off the point.

2. LAKE HERRING (GENERAL AREA).
   Referred to generally by four fishermen as herring grounds.

3. LAKE TROUT.
   Referred to by four fishermen. Type of trout were "big redfins," and substrate was honeycomb.

4. TWO RIVERS HARBOR: Yellow perch.
   Referred to by three fishermen.

5. YELLOW PERCH.
   Referred to in general terms by seven fishermen.